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This study addresses the mission of aerial resupply to encircled forces during a NATO versus Warsaw Pact conflict in Central Europe. Using, as a basis, European weather characteristics, the Soviet anti-air threat, and an armored brigade's resupply requirements, the C-130 and the Advanced Medium STOL Transport (AMST) are compared with each other and the overall mission requirements.

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The AMST's all-weather STOL capability, greater survivability in a hostile environment, and larger payloads offer significant advantages over the C-130. However, the success of the aerial resupply mission may largely depend on the ability of supporting tactical air forces to provide an effective air defense suppression and counterair campaign.

AERIAL RESUPPLY OF ENCIRCLED ARMY UNITS

DURING A MID-INTENSITY EUROPEAN WAR

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

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The opinions and conclusions expressed herein are those of the individual student author and do not necessarily represent the views of either the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

An attack by the Warsaw Pact on NATO will probably be conducted with high speed armor thrust trying to encircle NATO forces. If encirclements are successful, aerial resupply will have to sustain the encircled units until breakouts or link-ups can be accomplished. This study addresses the aerial resupply mission and the three primary factors that impact on it: weather, Soviet anti-air threat, and resupply requirements. Using these factors as a basis, the C-130 and the Advanced Medium STOL Transport (AMST) are compared against each other and the overall mission requirements.

Resupply operations in the U.S. V and VII Corps areas of West Germany will require an all-weather airlift capability. Presently, the AWADS equipped C-130s can conduct all-weather airdrops, but have a limited all-weather airland capability. New systems, such as the Global Positioning System, will offer navigational improvements and enable the AMST to conduct all-weather STOL operations.

The Soviet air defense weapons, both ground-based and fighters, pose the most difficult challenge. To counter these threats supporting tactical air forces will have to conduct effective suppression and counter air campaigns. However, the AMST with its 30 percent faster speed, and ECM and IRCM equipment will require less support than the C-130.

The AMST will provide a greater airlift capability than the C-130. To resupply an armored brigade the AMST requires 25 to 38 percent less sorties, depending on the delivery mode. However, the AMST's most significant advantage lies in its STOL capability. It can use 90 percent of the V and VII Corps' airfields, while the C-130 can use only 24 percent.

The AMST provides significant advantages over the C-130, however a successful resupply mission may depend on the effectiveness of the suppression and counter air campaign as much as the particular airlift aircraft used.

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CHAPTER I

INTRODUCTION

The aerial resupply of encircled army units is one of the most important and most difficult tactical airlift missions. Usually vulnerable aircraft must overfly enemy controlled territory to maintain the only line of communication (LOC) an encircled unit possesses. In future conflicts, with the great mobility modern armies now have, there is a likelihood that the surface supply lines of large ground units may be severed. To prevent capitulation, tactical airlift forces must be able to operate in all kinds of weather and withstand all enemy threats in sustaining the ground units. This report examines the challenges imposed on this particular airlift mission and the ability of tactical airlift aircraft -- the C-130 and the proposed Advanced Medium STOL Transport (AMST) -- to meet those challenges in a European mid-intensity conflict.

BACKGROUND

Soviet Doctrine

During the initial phase of an attack on North Atlantic Treaty Organization (NATO) forces in Europe, the Warsaw Pact will strive for rapid penetrations leading to encirclements of NATO forces. The depth of the

encirclements may extend to a distance of 250-280 kilometers, enveloping NATO's corps reserves as well as the forces in contact. If successful in this initial phase, the Warsaw Pact will continue the attack to destroy NATO's strategic reserves and logistics bases.[1]

Much of the current Warsaw Pact offensive doctrine is a continuance of tactics the Soviet Army used during the latter stages of World War II. Colonel V. Ye. Savkin, faculty member at the Soviets' Frunze Military Academy, describes in his book The Basic Principles of Operational Art and Tactics, that the encirclement concept was tried with increasing regularity after its initial success at Stalingrad late in 1942. Of the 140 German divisions destroyed in 1944, 70 were attributed to penetrations and ensuing encirclements. Savkin also states that on the modern battlefield, tactical maneuver in its most decisive form is either close or deep envelopment or a combination of the two.[2]

During World War II many German units were supposedly surrounded due to peremptory orders that did not allow for withdrawal. However, Colonel A. A. Sidorenko, author of the book, The Offense, A Soviet View, believes many envelopments developed because of tenacious Soviet frontal assaults that prevented the Germans from retreating. He goes on to say that present Soviet tactics are similar. That is, frontal assaults will be made to restrict enemy maneuver while, at the same time, attacking forces will seek flank penetrations that will allow for eventual encirclements. An integral

part of the overall attack will be its high tempo, a requisite under which the attack will be continuously pursued night and day and under any weather condition.[3]

Following World War II, a committee of high ranking German officers who had been involved with Soviet encirclements wrote about their experiences and provided recommendations in a pamphlet entitled Historical Study. Operations of Encircled Forces, German Experiences in Russia. They stated that since mobile warfare increases the chances of encirclement, appropriate tactical measures must be taken to maintain the trapped unit's usefulness, i.e., to tie down large numbers of the enemy and stage a breakout. Sometimes a critical factor in achieving this goal is resupply by aircraft. They recommended that the resupply effort start as soon as possible to ensure an adequate amount of fuel, ammunition and other critical supplies. Also, wounded and nonessential personnel need to be evacuated by air if at all possible.[4]

Aerial resupply was critical to encircled German units during World War II, but Luftwaffe airlift capabilities were very limited in both payload per aircraft and total numbers of aircraft. With the airlift resources available the Luftwaffe was not able to resupply large units.

Factors Impacting on Aerial Line of Communications (ALOC)

The Allied Air Forces, especially the U.S. Air Force and the Royal Air Force, enjoyed an advantage over the Luftwaffe in the availability of large numbers of transport

aircraft. Therefore the aerial resupply of sizable ground units was possible in the absence of bad weather and hampering enemy actions. One such resupply attempt occurred during Operation Market Garden. As part of the operation, the British airdropped the 1st British Airborne Division into Arnhem, Holland, to secure the Rhine River Bridge. From the time of the airdrop until the ground link-up, the division was to rely on aerial resupply. Although the initial drop was a complete success, the resupply missions were essentially failures. German fighters and air defense batteries, along with bad weather, produced havoc on the aerial resupply effort.[5] Without the sustaining supplies and reinforcements or a quick ground link-up, the airborne division was doomed to failure. Although Market Garden was a failure for a number of reasons including poor communications between ground and air forces, the operation does illustrate what a staunch air defense and bad flying weather can do to an ALOC.

In the modern era the two factors of air defense and weather still pose the greatest challenge to the aerial resupply mission. Both factors will be especially pertinent for U.S. tactical airlift forces operating in a NATO versus Warsaw Pact conflict in Central Europe. The Warsaw Pact's air defense capability is formidable, as evidenced by the Soviet equipment used in the October 1973 Middle East War.[6] Also, the weather of Central Europe can present serious problems, especially during the winter, when from December through February cloud cover is at or below 1,000 feet for more than one-third of the time.[7]

An additional challenge imposed by modern warfare is the massive supply requirements of an army unit engaged in heavy combat. Major General Chaim Herzog, in his book The War of Atonement, October 1973, describes Israel's logistics experience in the latest Middle East conflict. He wrote:

> The intensity of the War took the quartermaster staffs by surprise. The expenditure of ammunition was inordinately high, the losses of aircraft were severe, the figures of tanks destroyed alarming. It was clear that the staff tables on the basis of which equipment and ammunition had been stockpiled over the years required drastic revision.[8]

The sophisticated weapons used in the October 1973 War were responsible for the high consumption rate and probably typify the armaments that will be used in a NATO versus Warsaw Pact conflict. Therefore, if NATO units were encircled by Warsaw Pact forces, massive requirements for aerial resupply can be expected.

Conclusion

A Warsaw Pact attack against NATO in Central Europe will be conducted with high speed armor thrusts trying to encircle NATO forces in contact, to include corps reserves. If the encirclements are successful, ALOCs may have to be established to maintain the usefulness of the enveloped NATO units until a breakout or ground link-up can be accomplished. The successful conduct of ALOCs will be difficult because weather, Soviet air defense capabilities, and resupply demands will pose severe challenges to aircraft and aircrews maintaining the ALOCs.

PROBLEM STATEMENT

The aerial resupply problem, if placed within the NATO versus Warsaw Pace scenario, can be expressed by the following question: Can the United States Air Force tactical airlift forces, using the C-130 and/or the AMST, support encircled army units during a European mid-intensity conflict? Within the context of this question the following definitions apply:

> Mid-intensity conflict: War between two or more nations and their respective allies, if any, in which the belligerents employ the most modern technology and all the resources in intelligence; mobility; firepower (excluding nuclear, chemical, and biological weapons); command, control and communications; and service support for limited objectives under definitive policy limitations as to the extent of destructive power that can be employed or the extent of geographic area that might be involved.[9]

> Tactical airlift: Local intra-theater airlift of personnel, equipment, and supplies from major aerial ports to the user in the field utilizing various delivery techniques.[10]

Although the above question provides the focus for this study, the following questions are investigated in order to provide additional direction to the study.

- What are the factors and their characteristics that affect the aerial resupply problem, i.e., climatic conditions, enemy air defense capabilities, and the size of the airlift support required by encircled forces?

- What are the relative differences in capabilities between the two aircraft -- C-130 and AMST -- to meet the aerial resupply requirements?

- Can the C-130 and/or the AMST meet the requirements

of maintaining adequate ALOCs to encircled units in a NATO versus Warsaw Pact conflict?

ASSUMPTIONS/LIMITATIONS

This report is based on the following assumptions and limitations:

- Aerial supply to encircled units is the only type mission considered.
- Theater of operations will be Central Europe.
- Conflict will be of mid-intensity.
- The C-130 and the AMST are the only aircraft considered. The C-130 is currently the only tactical airlift aircraft used by active duty forces. The AMST, which is presently represented by two prototypes, the YC-14 and the YC-15, is expected to eventually replace the C-130.
- The report is unclassified.

APPROACH

To address the problem statement and its underlying questions, the three factors of weather, Soviet anti-air threat, and resupply requirements are treated separately and provide the organizational basis of this study. Weather is examined by determining and then describing Central European climatic characteristics. The anti-air threat is addressed by examining Soviet antiaircraft guns, surface-to-air missiles (SAMs) and fighter aircraft. The resupply requirements are scenario dependent, i.e., the size and type of encircled army unit. However, by using Soviet tactics

and U.S. Army units now stationed in Europe, reasonable assumptions can be made and resupply demands can be estimated and examined.

Once the challenges of each factor on the ALOCs are described, the capabilities of the C-130 and the AMST to meet these challenges are compared. The comparison is not only made between each type of aircraft but also between the ability of each aircraft to meet the requirements of the resupply mission.

Any deficiencies that evolve from the comparisons are further examined for possible solutions. Finally some corrective recommendations are made.

ENDNOTES

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CHAPTER II

THE TACTICAL AIRLIFT AIRCRAFT

The C-130 revolutionized tactical airlift when it was introduced in 1956. This aircraft presented a vast improvement in payload and speed over its predecessors while maintaining their short and rough airfield landing capabilities. A similar revolution will occur again in the early 1980s with the introduction of the Advanced Medium STOL Transport (AMST). This new aircraft will be capable of carrying larger payloads in terms of both weight and volume, and it will have an exceptional short takeoff and landing (STOL) capability.

Since the C-130 will remain in the tactical airlift inventory, even after the introduction of the AMST into the active forces, the capabilities of both aircraft will be examined in this and the following chapters. The purpose of this chapter is to address each aircraft's basic characteristics and to compare their differences. The following chapters examine aircraft capabilities with respect to certain factors that can affect the aerial resupply mission, i.e., weather, anti-air threat, and required airlift capabilities.

C-130

The Lockheed C-130E and C-130H tactical airlift aircraft used by today's active duty forces have grown in capability since the original "A" model was produced. The newer C-130 aircraft have 52 percent more range and can carry a 26 percent heavier load.[1] They can accommodate a normal allowable cabin load (ACL) of 39,100 pounds (2.5g load factor) but have an emergency overload capability of 50,000 pounds.[2] Carrying the normal ACL, the aircraft can cruise at a true airspeed (TAS) of 280 knots over a distance of 2,200 nautical miles (NM), but if maximum fuel is used, which decreases the ACL to 17,800 pounds, the range increases to 3,880 NM. Without any cargo the aircraft can be ferried over 4,470 NM.[3] In describing the C-130, the model designations (E or H) will not be referred to again unless a distinction has to be made.

Short Field Capabilities

The short field capability of the C-130 aircraft can be improved by making trade-offs between the payload and the landing distance. That is, the less weight carried, the shorter the landing distance. When carrying the normal ACL of 39,100 pounds, the landing distance of the C-130E is approximately 4,400 feet and the C-130H is approximately 3,800 feet. For takeoff at the same maximum weight, the C-130E requires 5,100 feet and the C-130H requires 4,200 feet.[4] Both landing and takeoff distances are for standard day, sea level conditions.

Airdrop Capabilities

The C-130 can use a number of air delivery methods: among the most commonly used are the Low Altitude Parachute Extraction System (LAPES), Container Delivery System (CDS), and conventional airdrop.

LAPES. The LAPES delivery technique is self-contained and has the capability of delivering loads between 3,780 and 36,700 pounds. However, the LAPES has a growth potential to 50,000 pounds. The aluminum cargo platforms are used to support the load and can be assembled in lengths of 12, 16, 20, and 24 feet. A single platform or a combination of two or three platforms connected in tandem can be delivered during a single pass. The platforms are extracted from the aircraft by means of a parachute when the aircraft is five to ten feet above the ground and its speed is approximately 130 knots.[5] The extraction zone must be relatively flat and smooth and at least 750 feet long and 50 feet wide. A clear zone of at least 800 feet must also be provided on the approach end, and between 450 and 1,550 feet on the departure end, depending on elevation and temperature.[6]

CDS. CDS airdrop method provides a method for delivering concentrated resupply loads in individual containers. The C-130 can deliver up to 16 A-22 containers in either single or multiple drops. The maximum size of the container is 48x53.5x60 inches, and it can weigh up to 2,200 pounds. Each container has an individual chute which provides a rate of descent of 100 feet per second (FPS) for

high altitude drops of 30 FPS for low altitude drops. Delivery altitudes that can be employed range from 600 to 25,000 feet.[7] The minimum drop zone required for a single container is 600 feet wide and 750 feet long. For deliveries of more than 10 containers, the drop zone's length must be increased to 1,650 feet.[8]

Conventional airdrop. The conventional airdrop method is capable of delivering personnel, equipment, or supplies. For equipment or bulky supplies the payload is mounted on platforms that range in lengths of 8 to 24 feet. The weight of the payload may vary between 2,520 and 36,700 pounds.[9] The drop zone required for this type of drop is large when compared with the preceding methods; 1,800 feet wide and 3,000 feet long for one platform. For each additional platform, an additional 1,200 feet must be added to the length of the drop zone.[10] For the C-130 to execute a heavy equipment or supply drop, the aircraft must be at an absolute altitude between 1,000 and 1,500 feet with an airspeed of 130 knots indicated airspeed (KIAS). The aircraft must approach the drop zone on a given axis and attain the drop altitude and airspeed at least two nautical miles (NM) from the release point.[11]

The advantages and disadvantages associated with the three aerial delivery methods will be discussed in Chapter V when resupply requirements are examined.

All-Weather Delivery Capability

A number of all weather navigational aids are

available for both C-130 airland and airdrop operations. The Adverse Weather Aerial Delivery System (AWADS) and the Station Keeping Equipment (SKE) are self-contained and do not require external aids, while the GCA/Doppler Aerial Delivery System and the Ground Radar Aerial Delivery System (GRADS) depend upon a ground based radar.

AWADS. The AWADS is a multipurpose avionics system that can be used to determine a computed air release point (CARP) for an airdrop or to provide the aircrew an airborne radar approach (ARA) during low-visibility conditions. Under current Military Airlift Command (MAC) regulations, the ARA can be made in weather conditions of a 300 foot ceiling or greater and a visibility of a mile or more.[12] The AWADS is composed of a dual frequency, X and Ka band, radar and a navigational computer. The radar furnishes precision ground mapping to the navigation computer which in turn provides both steering and release information to the crew.[13]

SKE. The SKE system is used to provide position and maneuvering information between inflight aircraft or between an aircraft and a ground based zone marker. The principle of SKE is time frequency sharing, which allows clocks in different aircraft to synchronize to the clock in the master aircraft. This allows for up to 36 aircraft to maintain a fixed three-dimensional formation. If the master aircraft contains an AWADS, all 36 aircraft can use the master aircraft's computed CARP for airdrops.[14]

GCA/Doppler Aerial Delivery. The GCA/Doppler Aerial Delivery System uses a ground controlled approach (GCA) radar to position the aircraft over a preselected timing point from which dopler/timing can be used to navigate to a CARP.[15]

GRADS. GRADS, a pure radar control system, eliminates the doppler/timing method and instead uses only ground radar information until the airdrop release point is reached. The GRADS requires a minimum of on-board navigation to complete a low visibility airdrop.[16]

The navigational systems described thus far are unique to the airlift mission, but conventional instrument approaches, such as GCA radar and Instrument Landing Systems (ILS), are also commonly used, especially at established airfields. Both conventional and airlift unique instrument approach systems will be examined in Chapter III when European weather conditions and their effects on an ALOC are discussed.

Countermeasures

Presently, the C-130 is not equipped with electronic countermeasures (ECM) equipment. However, infrared warning and counter-measure (IRCM) equipment does have a top Military Airlift Command (MAC) priority for inclusion into the aircraft.[17]

AMST

An objective of the AMST program is to develop an aircraft with the following characteristics:

> ...safe STOL performance, a high flotation landing gear, good ground mobility, an optimized weight/volume cargo compartment and a high speed global deployment capability.[18]

In other words, the AMST will be a deployable aircraft that can carry most of the Army's equipment, in great quantities, into short, austere airstrips.

Presently two AMST prototypes are flying, the Boeing YC-14 and the McDonnell Douglas YC-15. The YC-15 first flew in August 1975 and has completed the testing phase. The YC-14 did not fly until August 1976 and will not complete the testing program until mid-1977. If, through testing, the AMST concept is proved and the aircraft is procured, it may be 1983 before the U.S. Air Force receives the first production AMST. However, once the AMST becomes available, it will probably provide the mainstay of the future tactical airlift force.

The AMST will be able to carry a normal payload of 62,000 pounds (2.5g load factor) and will probably have an overload capability of between 78,000 and 86,000 pounds (2.25g load factor).[19]

Carrying an ACL of 62,000 pounds, the aircraft will be able to fly approximately 1,000 NM. For intertheater deployment the AMST will have a range of 2,600 NM and be able to airlift 38,000 pounds. Its ferry range on internal fuel will be at least 3,600 NM, but can be extended with inflight refueling. The aircraft will have a cruise capability of at least 400 KTAS.[20]

Short Field Capability

The AMST is designed specifically for STOL operations. At sea level and a temperature of 103 degrees Fahrenheit, the aircraft will be able to deliver 27,000 pounds of payload into a 2,000-foot long by 60-foot wide unimproved airfield.[21] At the normal ACL, 62,000 pounds, the AMST will be able to land and takeoff from a 3,500-foot airfield.[22]

Airdrop Capabilities

The AMST will incorporate many of the current systems employed by the C-130.

LAPES. By using LAPES the AMST will be able to deliver at least a 40,000-pound payload with a probable delivery capability of 50,000 pounds.[23] Delivery procedures will probably remain similar to those used by the C-130.

CDS. Using CDS, the AMST will be able to airdrop a minimum of 22 A-22 containers.[24]

Conventional Airdrop. Current airdrop techniques can be incorporated into the AMST. However in addition to present capabilities, the AMST may be able to conduct high speed airdrops. Present parachute technology is capable of producing extraction and recovery parachute systems that can withstand a 400-knot environment, and this capability is being emphasized in AMST design.[25]

All-Weather Capability

Present avionics equipment such as AWADS can provide

the AMST with an all-weather airdrop and a limited airland capability. A greater capability appears possible though, if newer navigational systems, some of which are still under development, are incorporated into the aircraft. The Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio, has conducted an exploratory study on suitable AMST avionics, where new systems like the Global Position System (GPS) and OMEGA, a VLF radio navigational system, have been examined.

When GPS is fully operational in 1984, 24 satellites will provide worldwide emphemeris and time reference data to suitable receivers. The GPS receivers will be able to determine their position to within 10 meters in three-dimensional coordinates.[26]

If the AMST is equipped with the appropriate GPS receiver equipment, the aircraft will be able to make highly accurate airdrops and instrument landings. Using GPS in conjunction with an inertial navigation system (INS), CARPs with a circular error probable (CEP) of approximately 30 meters should be possible, i.e., the aircraft has a 50 percent chance of being within 30 meters of the true CARP.[27] This is a three-fold increase over the capability of existing equipment, including the use of a ground based zone marker (SKE type). Using GPS for CARP determinations can reduce the aircraft's navigation error to a degree that the dominant airdrop error source may become wind variations between the aircraft and the ground. However, low altitude airdrops can be used to diminish wind effects.

GPS can also be used for precision instrument approaches. This capability requires that the aircraft's position be measured in both the horizontal and vertical plane. A GPS receiver can make both of these determinations to within 10 meters. Thus, a properly equipped AMST will be able to make precision instrument approaches, independent of ground based systems, anywhere on the globe.

Other avionic systems being considered for the AMST include a precision mapping radar (200-foot CEP position resolution); OMEGA, a very low frequency navigational system (2 NM CEP); INS and a doppler system. A mixture of these systems, excluding GPS, will be capable of providing a CARP determination within approximately 100 meters CEP and a non-precision instrument approach capability.[28]

One unique capability placed on AMST avionics design is the ability to conduct STOL precision approaches to Category II ILS minimums (1,600 feet visibility).[29] To maintain the six degrees or more STOL glide slope, the pilots will require visual augmentation to permit simultaneous viewing of the landing area and flight control data. Also, a flare command or autoflare, depiction of touchdown point, accurate indication of altitude, and automatic reconfiguration of aircraft for go-around will be required.[30] If steep glide slope control is incorporated with GPS precision guidance, the AMST can have an all-weather capability, independent of ground based systems, into short and austere airfields.

<u>Countermeasures</u>

IRCM equipment is being planned for the AMST, and wired hardpoints that can accommodate ECM pods are being considered.[31] The hardpoints will permit ECM pods to be carried on an "as required" basis.

The IR warning receiver upon detecting the presence of an incoming missile, can be given the capability to automatically dispense flare decoys. One proposal is to have four flare dispensers, two on each side of the aircraft to permit simultaneous ejection from both sides.[32] As an additional countermeasure, low IR reflectance paint can be used to minimize missile lock on due to sun glint.

COMPARISONS

The AMST will offer significant improvements in tactical airlift capabilities when compared to the present day C-130. The AMST will be able to carry more, fly longer distances, and land on smaller runways. Comparisons between the AMST and C-130 are given for payload in Table 2.1, and for STOL capabilities in Table 2.2.

The larger AMST cargo compartment offers a significant advantage when airlifting army equipment. Of 190 major equipment items in U.S. Army divisions, the AMST can transport approximately 92 percent while the C-130 is capable of transporting only 52 percent.[33]

Table 2.1 Volume and Maximum Payload Capabilities

Characteristics	C-130	AMST
Cargo Compartment Size (Height x Width x Length)	9x10x41 ft	11.3x11.7x47 ft
Cargo Compartment Volume	4,650 cu.ft.	7,762 cu.ft.
Maximum ACL (2.23g load factor)	50,000 lbs	78,000-86,000 lbs
Maximum ACL (2.5g load factor)	39,100 lbs	62,000 lbs

Table 2.2 Field Length/Payload Capability
(Sea level/103 degrees Fahrenheit)

Landing	C-130H	AMST
2,000 ft. Field	Unable	27,000 lbs
2,500 ft. Field	Unable	40,000 lbs
3,000 ft. Field	10,000 lbs	53,000 lbs
Takeoff	**C-130H**	**AMST**
2,000 ft. Field	10,000 lbs	27,000 lbs
2,500 ft. Field	25,000 lbs	41,000 lbs
3,000 ft. Field	35,000 lbs	51,000 lbs

Source: Headquarters, Air Force/RDQRA, "AMST BRIEFING" (November 1976).

The AMSTs range and airspeed capabilities will also be superior. Using only internal fuel, the range of the AMST will be greater than the C-130 for a given payload. Further, the AMST will also have an inflight refueling capability, whereas the C-130 does not. To cover the same distance the AMST will require 30 percent less time than the C-130; the AMST having a 120 KTAS advantage over the C-130.

The AMST may have a greater all-weather capability than the C-130 if the AMST is equipped with newer avionic systems, such as a GPS receiver, and the C-130 continues with present systems. The AMST does have an avionic compatibility advantage over the C-130 because the newer systems can be an integral part of the AMST design. Radios and instruments can be placed in optimum positions on the AMST whereas on the C-130 this may not be possible.

All-weather STOL operations will provide the AMST with a distinct advantage. Coupled with GPS, the STOL precision instrument approach will give the AMST a unique all-weather airland capability into short austere airfields.

In an anti-air threat environment the AMST will be better equipped to survive than the C-130. For defense against enemy SAMs, the AMST's IRCM and ECM pods will offer some protection. At present the C-130 has no CM capability, but it may receive an IRCM system in the future. Against enemy ground based gun systems the greater speed of the AMST will offer less exposure than the C-130.

The AMST will offer a much greater overall performance capability than the C-130, but how important is this to the mission of resupplying an encircled army unit during a mid-intensity European conflict? The degree of importance that AMST's additional capability offers will be examined in Chapters III, IV and V.

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CHAPTER III

EUROPEAN SETTING AND CLIMATE

The effects of climatic conditions upon an ALOC depends upon a number of factors: location of the route of flight, to include the base of departure and arrival point, season of year, and the all-weather capability of the particular airlift aircraft. In this chapter, the climatic effects on an ALOC originating in Southern England and terminating in the U.S. Army's area of responsibility in West Germany are explored. Finally, the navigational capabilities of the C-130 and the AMST to operate in the described climatic conditions and to maintain the ALOC are examined.

ALOC

The two primary tactical airlift bases in Europe are located at RAF Mildenhall, located in Southern England, and Rhein-Main Air Base, located near Frankfurt, West Germany.[1] Both of these can be major support facilities for tactical airlift operations during a NATO versus Warsaw Pact conflict. However, if Warsaw Pact forces are conducting an offense into West Germany, RAF Mildenhall provides the more secure staging base for aerial resupply missions. For the purpose of this analysis RAF Mildenhall will serve as the departure base.

In an offensive thrust by the Warsaw Pact, the most likely areas for encirclement are approximately where the NATO forces are positioned today (Figure 3.1).

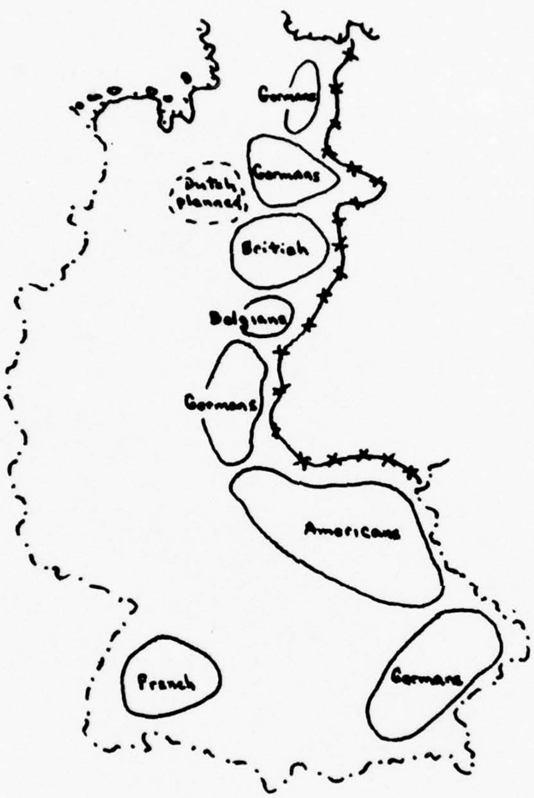

Figure 3.1

Current Disposition of NATO Forces in West Germany (From "Inflexibility in NATOs Flexible Response", Military Review, January 1976)

The U.S. Army's area of responsibility is located in Southern West Germany where the V and VII Corps are positioned (Figure 3.1). It is this area that will be examined as terminal point of the ALOC.

There are an infinite number of ALOCs that may be

required during a Warsaw Pact invasion of Western Europe, but the air route between RAF Mildenhall and V and VII Corps is considered by the writer to be typical of the ALOCs that may be required.

CLIMATE

Required Weather Minimums

Weather can affect airlift operations during three phases of flight: takeoff, enroute, and during the landing or airdrop. During the resupply of encircled forces, the most critical phase will be during the landing or airdrop. Due to the austere environment there will be a minimum of outside navigational aids and the aircrews will have to rely primarily on the internal navigational capability of their aircraft. An exception to this will be GPS receiver equipped aircraft after 1984.

Weather conditions during the other two phases of flight, departure and enroute, will not be as critical. At the departure, or staging base, sophisticated navigational aids such as GCA radars or ILS will probably be available. Under normal GCA weather minimums, of 1,600 feet visibility, airfield operations will rarely cease. Even when the visibility is below GCA minimums, instrument takeoffs can be made if mission requirements dictated. Enroute weather conditions will rarely affect the mission. Presently, tactical airlift aircraft have sufficient navigational equipment for enroute guidance, e.g., doppler, radar, LORAN, etc.

Although weather will not generally hamper takeoffs or enroute flight, the visibility and ceilings in the area of the landing or airdrop may have a more pronounced effect. To accomplish either of the two types of airdrops given in Table 3.1, the cloud ceiling and visibility must permit the visual determination of the drop zone, or an all-weather system must be used such as AWADS, GCA/Doppler Aerial Delivery or GRADS.

Table 3.1 Airdrop Minimum Altitudes

Type	Absolute Altitude
Equipment/Supplies	1,100 feet, below 5,000 feet MSL
	1,500 feet, above 5,000 feet MSL
CDS--G-13/G-14/T-7C	500 feet
G-12	600 feet

Source: Military Airlift Command, C-130 Aircrew Operational Procedures, MAC Reg 55-130 (17 October 1975), P.4-1.

For an airland or LAPES delivery, the visibility and ceiling conditions must be above the minimums for the particular navigational system and airfield being used. Normally, for an AWADS airborne radar approach (ARA) the minimums are given as 300 foot ceiling and a visibility of a mile.[2] Where radar GCA and ILS precision approaches are available, the minimums can be very low (visibility of 1,600 feet), but again this capability will be associated with established airfields, and will not normally be found in the area of encircled army forces. When it becomes operational

in 1984, GPS will permit precision approaches into austere airfields, since ground based equipment will not be required.

Depending on the navigational equipment available, weather conditions can restrict airdrops or landings. As shown in Table 3.1, if cloud ceilings go below certain heights, then suitable navigation equipment will be required for airdrops. For airland or LAPES deliveries during poor visibility or low cloud ceilings, sophisticated navigational aids will be needed, e.g., AWADS, GCA radar, ILS, or eventually, GPS.

Climatic Conditions

The weather conditions in Central Europe are closely associated with particular seasons.

Table 3.2 Average Cloud Ceilings

Ceiling(ft)	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb
None	29.7%	33.9%	25.1%	15.7%
2,000+	49.2	50.2	42.3	41.2
1,500-2,000	3.9	2.4	4.0	5.6
1,000-1,500	5.4	3.9	6.2	9.8
500-1,000	6.5	5.0	8.0	14.1
Under 500	5.3	4.6	14.4	13.6

Source: U.S. Army Command and General Staff College, Operations, RB 100-5-1 (July 1976), p. 13-12.

As can be seen in Table 3.2, maximum cloudiness occurrs in winter usually in the form of thick, low stratus. During the December through the February time frame there is cloud cover over the V and VII Corps areas between 20 to 25

days per month. In the Fulda and Hanau areas (Figure 3.2) cloud ceilings below 3,000 feet occur 60 to 70 percent of the time and ceilings below 1,000 feet occur about 30 percent of the time. For ceilings below 3,000 feet there is not much diurnal variation.[3]

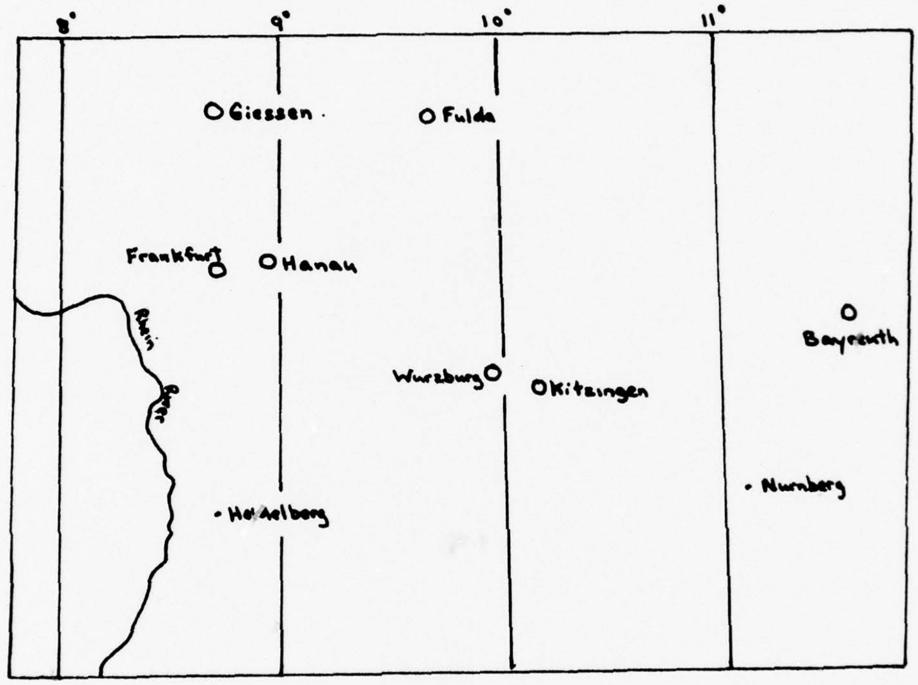

Figure 3.2

Weather Stations in V and VII Corps

(From "The Effect of Weather Conditions on Air Operations in West Germany," Institute for Defense Analysis, June 1965)

Actually, autumn (September through November) experiences almost as much cloud cover as winter. The annual maximum for ceilings below 200 feet occurs in October when

13 percent of all hours are below 200 feet.[4]

Visibilities during the autumn and winter seasons can be severely limited due to fog. An abundance of radiation cooling, coupled with moist air, produces fog formations that frequently restrict visibility to less than 2½ miles. In January the visibility will be below 2 miles 35 percent of the time.[5]

During the autumn and winter seasons the ceiling and visibility conditions vary little over the V and VII Corps areas. Table 3.3 gives the frequency of occurrence of low ceilings and visibilities during this period for different area weather stations. (Detailed climatic summaries of selected airfields are provided in Appendix B.)

Table 3.3 Ceilings and Visibilities (October through March)

	Condition		Occurrence (Percent)	
Weather Stn.	Ceiling(ft)	Vis.(mi)	0600-1100hrs	1200-1700hrs
Hanau	<1,000	<2	31.3	21.3
Fulda	<1,000	<2	45.0	27.4
Kitzingen	<1,000	<2	23.3	11.9
Frankfurt	<1,000	<2 1/3	48.2	31.4
Wurzburg	<984	<2 1/2	36.6	17.7
Giessen	<984	<2 1/2	31.1	19.5
Bayreuth	<984	<2 1/2	37.6	18.7
		Average	36.4	21.1

Source: Jean G. Taylor, "The Effect of Weather Conditions on Air Operations in West Germany," Institute for Defense Analysis (June 1965), p. 30.

Starting in the spring, (March through May) and lasting through the summer, there is a steady improvement in both ceilings and visibility. The most noticeable improvemnt occurs in ceilings below 1,000 feet, which decrease from 30 to 12 percent for all hours. Visibilities below the 2 miles occur only 7 percent of the time compared to 35 percent for all hours in January.[6]

Cloudiness during the summer (June through August) is at a minimum. Ceilings below 3,000 feet occur only about 24 percent of the time. Even though during the summer visibility is the best of any season, maximum precipitation due to thunderstorms will occur. Usually 8 to 12 inches are recorded in the Fulda Gap region.[7]

The extreme maximum temperature that can be expected during the summer is 94 degrees Fahrenheit, although the average daily maximum temperature is 72 degrees Fahrenheit and the average daily minimum is 51 degrees Fahrenheit.[8]

SUMMARY

The capability of the tactical airlift forces to meet the challenges posed by the Central European climate depends, to a large extent, on the equipment available. For example, if AWADS is in plentiful supply, then the tactical airlift force have an all-weather capability. Presently, only 53 out of 283 C-130s are equipped with AWADS.[9] Of course, for air drops SKE equipped C-130s can be used in conjunction with an AWADS equipped aircraft to make a formation delivery.

Presently, even with AWADS equipped aircraft, some limitations will be imposed by weather conditions on ARA and LAPES deliveries. During the fall and winter, when for approximately 18 percent of the time the ceiling is below 500 feet, airland or LAPES operations may not be possible. This will be especially true in January, when for 35 percent of the month the visibility is below 2 miles.

When GPS becomes fully operational in 1984, and if the AMST and/or C-130 are equipped with appropriate receiver equipment, a significant increase in all-weather airland and airdrop capabilities will exist. Precision instrument approaches using GPS will be comparable to present ILS and GCA ground-based systems. This new capability will permit continuous airland operations into austere airfields except during periods of very low ceilings and visibility (200 foot ceiling and/or ½ mile visibility, or less). However, during periods of "below minimums" or when there is a lack of suitable airfields GPS will permit highly accurate airdrops. Used in conjunction with an INS, CARP determinations of 30 meters or less will be possible.

At present the AWADS C-130 provides the tactical airlift forces an all-weather airdrop and airland capability. Limitations are imposed by the small number of AWADS equipped C-130s and weather minimums for ARAs which can restrict airland operations, especially during the autumn and the winter seasons. GPS, when it becomes operational, will provide a considerable improvement in both airdrop and airland capabilities. Incorporating GPS into the AMST will

give a unique STOL capability, permitting all-weather resupply of encircled forces using rudimentary airfields without ground based navigational systems.

ENDNOTES

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CHAPTER IV

ENEMY THREATS TO THE ALOC

The Warsaw Pact forces have a formidable air defense capability. Their fighter aircraft outnumber NATO's by a factor of two to one, and their ground-based weapon systems have the capability of providing an effective air defense umbrella. The effectiveness of current Soviet surface-to-air missiles (SAM) and antiaircraft artillery (AAA) was demonstrated during the first week of the 1973 Middle East War. The Egyptians, using Soviet made SAMs and AAA, prevented the destruction of their initial Suez Canal bridgeheads and advancing LOCs by the Israeli Air Force. During the same period, the Syrians using Soviet air defense equipment were also able to provide a protective air defense umbrella over their attacking forces on the Golan Heights. It was only after an intense SAM suppression campaign that the Israeli Air Force was able to gain complete control of the airspace above the battlefields.

The fact that the Israelis were able to suppress Arab ground-based air defenses by the third week of the war is important to NATO air force planners. In a NATO versus Warsaw Pact conflict, NATO will have to conduct a similar suppression campaign against many of the same Soviet air defense weapon systems. However, in the battlefields of Central Europe the Warsaw Pact can employ a higher

concentration of SAMs and AAA than employed by the Arabs against the Israelis. Also, NATO's suppression campaign may be more difficult due to the Soviets having recently deployed two new SAM systems to their field forces.

The degree of effectiveness attained in the suppression of Soviet ground-based air defense systems and the degree of air superiority achieved over Soviet fighters may be the primary factor in the ability of airlift forces to maintain an ALOC to an encircled unit. Another factor, although it may be less important, is the survivability characteristics of the airlift aircraft against SAMs and AAA. Some ground-based air defense weapons can be expected to survive even an intense suppression campaign and thus be able to engage airlift aircraft. The airlift aircraft need some capability to either evade or survive these engagements.

This chapter will examine the threats posed by Soviet SAMs, AAA and fighter aircraft; some U.S. Air Force weapon systems that are, or will be, available to counter the Soviet threats; and finally the survivability characteristics of the C-130 and the AMST.

SOVIET AIR DEFENSE SYSTEMS AND DEPLOYMENT

Ground-Based Air Defense Systems and Employment

Soviet weapon systems and employment concepts are presented in this chapter as representing the Warsaw Pact threat. Granted, if non-Soviet Warsaw Pact forces are holding the perimeter encircling the NATO unit, then the threat to resupply aircraft may be less, since non-Soviet

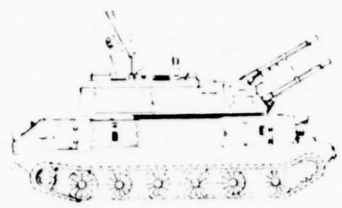
forces may not possess the latest AAA and SAM systems. However for this examination a "worst case" is assumed and a Soviet tactical army represents the threat.

An advancing Soviet tactical army, i.e., a combined arms or tank army, will consist of three to four divisions and will normally be responsible for the air defense along a 50 km front.[2] The depth of the tactical army's air defense zone will normally extend to 100 km. Even though only a small portion of the tactical army may be used as the encircling or blocking force, a large percentage of the army's AAA and SAMs, due to their mobility and range, may be effective in disrupting an encircled unit's ALOC.

According to a recent issue of Electronic Warfare, each of the five Soviet armies presently stationed in East Germany can deploy ground-based air defense weapon systems in the following quantities:[3]

ZU-23-2. A typical combined arms or tank army will contain up to 19 batteries (six guns per battery) of the ZU-23-2, twin-barrel, 23-mm antiaircraft (AA) gun. They can be found in the motorized rifle regiment and will be deployed within 5 kms of the forward edge of the battlefield (FEBA).[4,5] The ZU-23-2 is optically aimed and can fire 2,000 rounds per minute to a range of approximately 8,000 feet.[6] This range is the greatest distance given in selected non-classified sources. A "worst case" for all Soviet weapon system performance data is presented in this chapter, i.e., where

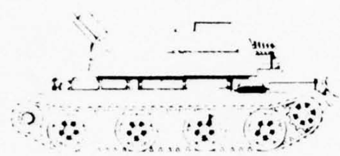
sources may conflict on performance, the best performance is cited. (Drawings are by courtesy of Air Defense Magazine).



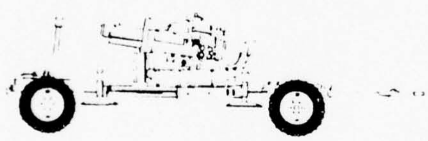
ZSU-23-4. Thirty-two batteries, or a total of 128 ZSU-23-4, quad-barrel, 23-mm, self-propelled AA gun systems are available to a tactical army.[7] Normally within a division one battery (four ZSU-23-4s) is assigned to each motorized rifle and tank regiment. This would leave approximately one-half of the batteries for deployment at tactical army level. With the ZSU-23-4 assigned at both regiment and army level, the weapon system will not only be found near the FEBA but throughout the army's sector. The ZSU-23-4 is highly mobile, being mounted on a modified armored vehicle chassie. Adding to the system's mobility is a gyrostabilized gun mount, which permits the weapon to be fired on the move. Target acquisition and tracking can either be done manually, through optical sights, or automatically, using a radar and fire control system. Once a target is acquired the ZSU-23-4 can fire 4,000 rounds per minute (1,000 per barrel) to a range of 8,200 feet.[9]

The editor of Aviation Week, Robert Hotz, called the ZSU-23-4 the most effective antiaircraft weapon used in the 1973 Middle East War.[10] It is believed to have accounted for approximately 30 per cent of downed Israeli aircraft.[11] Considering both the ZSU-23-4's combat proven capability and

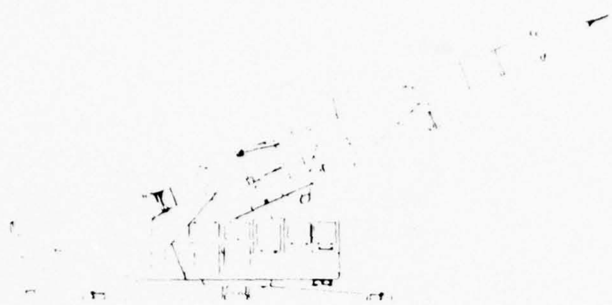
the quantity of systems available to a Soviet tactical army, this weapon system will present one of the foremost AA threats to low-flying NATO aircraft, including the C-130 or AMST.



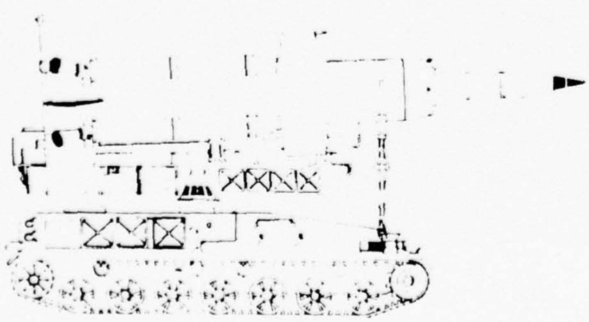
ZSU-57-2. Within a tactical army there may be 36 self-propelled ZSU-57-2 twin-barrel guns. One battery of six guns is assigned to a tank regiment if the SA-9 SAM is not available.[12] The ZSU-57-2 is optically aimed and has a range of approximately 13,000 feet with a rate of fire of 240 rounds per minute.[13]



S-60. The S-60 is a towed single-barrel AA gun which like the ZSU-57-2 uses a 57-mm round. However, unlike the ZSU-57-2, the S-60 is radar directed. The S-60 has a rate of fire of 120 rounds per minute with an effective range of 13,000 feet.[14] Twenty-three batteries (six guns each) are deployed throughout a tactical army. Normally, within each division's antiaircraft regiment four batteries of the S-60 will be available. The divisions will deploy some of their batteries within 10 km of the FEBA forming a protective belt across the entire width of the front. To add depth to the air defense, secondary S-60 AAA belts are established at 15 km and 25 km behind the FEBA.[15]

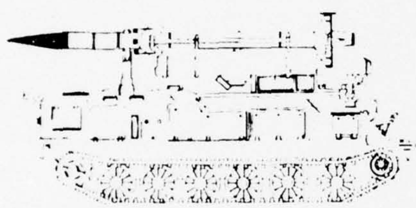


SA-2, Guideline. As part of an army's medium and high altitude SAM assets are three SA-2 batteries, each composed of six mobile launchers, a Fan Song fire control radar, and a loader vehicle. If properly positioned, the three SA-2 batteries have the range to cover most of an army's 50 km by 100 km sector. To provide this coverage an attempt will be made to place two of the SA-2 batteries approximately 45 km behind the FEBA and the third battery approximately 80 km behind the FEBA.[16] It is doubtful that an encircled NATO unit can occupy enough area within a Soviet army's sector to affect SA-2 positioning and the SAMs coverage above the army's sector. The SA-2 has a range of approximately 24.3NM (45 km) and a maximum ceiling of about 80,000 feet.[17]



SA-4, Ganef. Another medium to high altitude employed at army level is the SA-4. Typically the SA-4s are used to form two air defense belts. The forward belt, consisting of three batteries, will be positioned

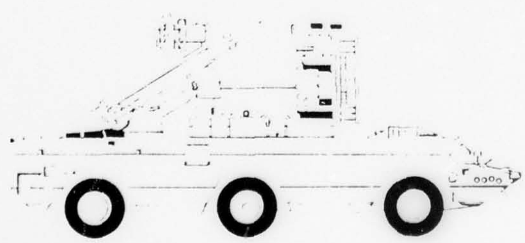
approximately 10 kms behind the FEBA permitting the SA-4s coverage to extend to more than 60 kms forward of the FEBA. The second belt, consisting of six batteries, will be positioned approximately 25 kms behind the FEBA to plug up any gaps in the forward air defense. Each SA-4 battery consists of three launchers mounted on tank chassies, one Pat Hand fire control radar, and one loader vehicle.[18] The SA-4 SAM has a slant range of approximately 37.8 NM (70 km) and a maximum effective altitude of about 80,000 feet.[19]



<u>SA-6 Gainful</u>. The Arabs used the SA-6 SAM with great success during the 1973 Middle East War. The system is very mobile, being mounted on a tank chassis, and was able to move easily with the forward elements of the Syrian and Egyptian ground forces. A Soviet army normally contains 10 SA-6 batteries, with the tactical army retaining control, except for the 3 or 4 batteries assigned to the divisions. Deployment of the SA-6 batteries will normally be in three echelons: the first echelon of five batteries being placed very close to the FEBA, the second echelon of three batteries positioned approximately 5 km behind the FEBA, and the two remaining batteries positioned approximately 10 km further to the rear.[20] Just how the emplacement of a NATO encircled unit within a Soviet army's sector may affect SA-6 deployment will depend upon the

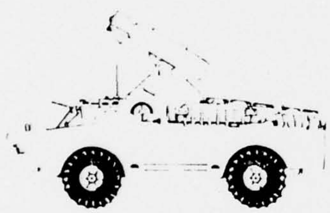
particular situation. However, the SA-6 SAM has the mobility and range to be effective over a very wide area. The range of the SA-6 SAM is 16.2-18.9 NM (30-35 km) at low altitudes and up to 32.4 NM (60 km) at higher altitudes.[21] Three launcher vehicles, along with one Pat Hand fire control radar, and one loader vehicle, make up a battery.

SA-7, Grail. The Grail is similar to the U.S. Army's Redeye missile. The SA-7 is shoulder-launched and uses an IR terminal homing device for guidance. It is distributed throughout the Soviet maneuver forces and within a tactical army the SA-7 is probably available in large numbers. During the three week 1973 Middle Wast War over 5,000 SA-7s SAMs were fired by Arab armies, although due to its small warhead, only a small number of Israeli aircraft were downed.[22] The SA-7 has a slant range of approximately 3.8 NM (7km) and an effective celing of about 10,000 feet.[23].



SA-8, Gecko. The Gecko is a new Soviet SAM that first appeared in November, 1975, and at the present time little is known about its deployment. The SA-8 is highly mobile and appears to compliment the capabilities of the ZSU-23-4 gun and SA-9 SAM. Therefore the SA-8 may be

colocated with these weapon systems in fast moving strike forces.[24] The SA-8 is self-contained in an amphibious, three-axle vehicle that includes radar and television guidance systems. A quad-launcher is mounted on top of the vehicle, although storage space exists for eight more SAMs. The system is reported to have the unique capability of launching two missiles simultaneously with each missile being guided on a different frequency. The range of the SA-8 missile is believed to be between 5.4 and 8.1 NM (10 and 15 km).[25]



SA-9, Gaskin. The Gaskin is another of the Soviet's newly developed SAM weapon systems. It is anticipated that 64 SA-9s will be employed within a tactical army, one battery per regiment, each battery consisting of four launch vehicles.[26,27] Each launch vehicle, which is amphibious and armored, contains a quad-launcher. The missile is reported to be similar to the SA-7, using the same IR homing device but with a larger rocket motor and warhead. The range of the SA-9 is approximately 3.8 NM (7 km).[28]

The Soviets have developed a variety of sophisticated ground-based air defense systems and have deployed them in quantity. Within the tactical army's 50 km front, the overlap coverage provided by just SAM systems is 20 times.[29] For NATO air forces to suppress, confuse, or evade this threat

will require a formidable array of CM systems. Systems that will be examined later in this chapter. However, Soviet ground-based antiaircraft systems are not the only threat, fighter aircraft present another serious challenge.

Warsaw Pact Fighter Aircraft

In Northern and Central Europe approximately 4,200 fighter aircraft are available to the Warsaw Pact, of which about one-half are classified as interceptors. This is twice the number of fighter aircraft possessed by the NATO air forces in the same region.[30] However, it may be not realistic to expect all of the Warsaw Pact fighters to be employed near the FEBA, since most of the non-Soviet fighters, 1,700 aircraft, will be used for homeland defense. The remaining 2,500 fighters belonging to Frontal Aviation, form the Soviet's tactical air force. This force, composed of the newest fighters, provides the greatest threat.

Included in Frontal Aviation's inventory are third generation aircraft such as the MIG-23 (Flogger B and D) and the SU-19 (Fencer). The Flogger B is the air superiority version of the MIG-23 and is equipped with a 23-mm cannon and the latest IR and radar homing AA-7 (Apex) and AA-8 (Aphid) air-to-air missiles. Over 1,200 MIG-23s are presently deployed with Frontal Aviation.[31] Considering its capability and numbers, this aircraft will pose a serious challenge to any NATO air operations.

The SU-19 (Fencer) may also present problems to aerial resupply operations. The Fencer has an all-weather, low-

level capability similar to the U.S. Air Force's F-111. A capability that may permit the aircraft, with its heavy bomb load, to cause havoc during the airdrop or airland operations of a resupply effort.

DEFENSE AND SURVIVABILITY OF AN ALOC

If an ALOC is to be maintained to an encircled unit, then the threats from Soviet fighter aircraft and ground-based air defense systems are going to have to be reduced to a level that tactical airlift forces can survive. Also, since all ground-based weapon systems may not be eliminated, the survivability characteristics of the particular airlift aircraft may be important.

Reduction of the Enemy's Air Defense

The threat posed by Soviet fighters aircraft is the easiest to discuss. Airlift aircraft, including the C-130 and AMST, cannot survive against an undefended air attack. Therefore, local air superiority is essential to an ALOC's survival.

The U.S. Air Force will be well equipped to accomplish this crucial air superiority task if the F-15, air superiority fighter, and the Airborne Warning and Control System (AWACS) are available. In recent tests the F-15/AWACS combination have proved to be a very effective team, even when confronted with the latest U.S. fighter and ECM aircraft. In one particular test two F-15s under the control of an AWACS aircraft defeated six F-4 fighters supported by three of the

U.S. Navy's latest ECM aircraft, the E-6A.[32]

Air superiority is not the only task for which AWACS can be used. Using its "look down," long range radar (more than 150 NM) early warning can be provided of approaching hostile fighter aircraft, even the low-level flying Fencer. This may also permit the AWACS controllers to vector airlift aircraft around or out of dangerous airspace.

To suppress the Soviet ground-based air defense systems may be more difficult than defeating the fighter aircraft threat. However, a number of air defense suppression weapons are presently in the U.S. Air Force's inventory and more are in the process of being developed. Again, a defense against SAMs and AAA does not necessarily mean the destruction of the missile or gun, but may be a deception device, e.g., ECM or IR flare pods, or if possible simply evading the threat altogether.

Currently, Wild Weasel aircraft are the U.S. Air Force's primary defense against SAMs and AAA. These modern fighter aircraft are equipped with receivers to detect and locate enemy radars and then can launch anti-radiation missiles to destroy them. Although this weapon system has been successful in the past, it may be not sufficient to counter the current Soviet threat.[33]

Under development are new weapon systems that promise to be more effective. One such system is the Precision Emitter Locator and Strike System (PELSS) which uses a time of arrival technique to locate enemy radars and then launches missiles against the target using distance measuring

equipment. This prevents a target radar from using the simple countermeasure of shutting down and thus depriving an incoming missile of a homing beam. Another new development program is a remotely piloted vehicle (RPV) that will loiter in the battle area and then home in on a defense radar when it emits. RPVs are also being explored as deception devices; i.e., the battle area will be saturated with these devices simulating attack aircraft, causing confusion and the unnecessary expenditure of SAMs and AAA ordinance. There are a number of other suppression systems under development such as improved ECM and IRCM equipment.[34]

Any discussion of suppressing ground-based air defenses is not complete without a brief discussion of the Israeli's success against Soviet made SAMs and AAA in the 1973 Middle East War. With the help of the Army, the Israeli Air Force had obliterated the Arab's SAM defense by the end of the three-week war.[35] The Israeli Air Force was able to exploit a serious flaw in the SAM network, i.e. the absence of the SA-4 and its associated Long Track radar. This absence left a serious gap in surveillance since the SA-6 has only a limited radar search capability and altitude discriminator; the Long Track radar normally provides the high altitude coverage. This radar deficiency permitted the Israeli Air Force to fly into the SA-6s area at high altitude and when over the target to use a steep attack profile to destroy SA-6 vehicles.[36] Another important factor in the success of this tactic was the availability of effective ECM equipment to deceive the SA-2 and SA-3 SAMs which the Arabs

used for high altitude coverage. In Central Europe this particular Long Track radar deficiency will probably not occur, but the Israeli success does illustrate what an aggressive suppression campaign can sometimes accomplish.

The battle between ground-based air defense systems and effective counter measures is a continuing affair. However, the U.S. Air Force, with the development of new suppression weapon systems, may in the near future have the advantage over Soviet SAMs and AAA. Of course, if an ALOC is to be maintained over enemy terrain, then the weapon advantage has to be such that the ground-based air defenses are reduced to a level that will permit airlift aircraft to survive.

C-130 and AMST Survivability

Even with a successful suppression campaign, some enemy weapon systems may remain to interfere with the ALOC. Then the success of the aerial resupply effort may depend on the capability of the airlift aircraft to provide for their own defense and absorb damage.

The C-130 does not currently carry any defensive systems, such as ECM or IRCM pods. However, as was discussed in Chapter II, MAC has established for the C-130 a high priority for the development of IRCM equipment.

The survivability of the C-130 against Soviet made AA gun systems was partially shown during the Vietnam War. In South Vietnam the SAM threat was not prevalent except late in the war when the SA-7 was employed. Since SAMs were not a

major threat, high flying C-130s were essentially immune to enemy fire when enroute to their destination. It was at their destination that the aircraft experienced problems with enemy ground fire. Two war-time examples stand out: Khe Sanh and An Loc. In both of these large scale resupply operations, the North Vietnamese Army employed a large number of AA guns, ranging in size from 0.51 caliber machine guns through the 23-mm, 37-mm, and 57-mm AA guns.

In the 1968 Khe Sanh operation over 836 C-130 sorties were flown in support of the encircled 6,000 U.S. and South Vietnamese man garrison. During the early phase of the resupply effort, airland operations were used exclusively, but later when the North Vietnamese were able to keep Khe Sanh's lone runway under constant mortar fire, only airdrops were made. During the two and one-half month siege, no C-130s were lost, although several were seriously damaged. The Khe Sanh operation was a complete success considering the small number of aircraft damaged, the number of sorties flown, and the supplies delivered.[37]

The 1972 An Loc resupply effort involved maintaining a continuous ALOC, to nine encircled South Vietnamese battalions, over approximately a three month period. The North Vietnamese Army employed the same types of AAA guns used at Khe Sanh, plus the SA-7 SAM.[38] At An Loc antiaircraft fire was so intense that during most of the operation, only high altitude airdrops were used. By the end of the siege, the C-130s had flown 603 sorties while losing two aircraft and receiving battle damage to many more.

However, the aerially delivered supplies permitted the beleagued units to block a major North Vietnamese attack.[39]

Although the survivability of the C-130 during operations in Vietnam was high, this experience cannot be easily extrapolated to a NATO versus Warsaw Pact conflict. Of course, attrition is going to be higher if the more sophisticated Soviet AAA and SAMs are allowed to engage C-130s. If however, the more lethal ground-based air defense weapons are suppressed, then the Vietnam experience shows C-130 losses may be kept within acceptable limits.

In a mid-intensity conflict, the AMST can be expected to survive better than the C-130. The AMST has three important advantages: speed, ECM and IRCM equipment, and limited armor protection. The AMST's high speed, approximately 400 KTAS, will provide 30 percent less exposure to enemy weapon systems than the C-130, an extremely important factor, especially at low-altitude, when enemy gunners are trying to track and shoot. The hardpoints on the AMST will be able to accommodate ECM pods and the advantages of these are self evident. The AMST's IRCM equipment, which is to be an integral part of the aircraft, will be designed to provide protection against the SA-7 and SA-9; SAMs which are found in large number throughout the Soviet tactical army and which are very difficult to suppress. The limited armor in the AMST's cargo compartment will offer protection for one crewmember, probably the loadmaster, during airdrops. Another airdrop advantage the AMST may have is a 400 knot capability. Normally during this maneuver the

aircraft is in its most vulnerable condition, i.e., low and slow, but with a high speed airdrop capability the aircraft's survivability will be greatly enhanced.

SUMMARY

The challenges imposed by Soviet AAA, SAMs, and fighter aircraft on an encircled unit's ALOC may be severe. However, the U.S. Air Force in the future may be able to conduct suppression and air superiority campaigns that will enable airlift aircraft to survive over the battlefield. New weapon systems, such as the PELSS, which will be used to seek out and destroy AAA and SAM sites, and the F-15/AWACS air superiority team, will provide new capabilities for the Air Force to accomplish the necessary tasks.

The survivability of the ALOC may not only depend upon supporting air forces, but also upon the inherent survivability of the airlift aircraft. Even with a successful suppression campaign, some ground-based air defense systems may continue to exist. In this environment the tactical airlift forces will be significantly enhanced with the availability to the AMST. With its faster speed, and ECM and IRCM protection, the AMST will be able to survive where the C-130 may not.

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CHAPTER V

RESUPPLY AND AIRLIFT REQUIREMENTS

To maintain an adequate ALOC to an encircled unit, the NATO air forces must have a sufficient airlift capability to carry the necessary supplies. Today this may not be an easy task considering the resupply demands of armored and mechanized units in NATO today. As the mobility and firepower of these units have increased, so has the demand for fuel and ammunition. This chapter examines the resupply requirements of particular armored units and the airlift requirements that can be imposed on U.S. Air Force C-130s or AMSTs.

SUPPLY REQUIREMENTS

Almost all U.S. Army combat forces in Europe are composed of "heavy" units, i.e., they are either armored or mechanized infantry. The two U.S. Corps, V and VII, each have an armored division, an infantry (mechanized) division, and an armored cavalry regiment. There are also 3 independent "heavy" brigades.[1] Any one of these U.S. units may be encircled if given a large enough enemy force and the right circumstances, but only the supply requirements of an armored division and an armored brigade will be examined in this chapter. The armored units require the greatest amount of supplies and therefore present a "worst case" to the tactical airlift forces.

Armored Division

Given in Table 4.1 are the daily resupply requirements of an armored division.

Table 4.1 Armored Division's Supply Requirements

Class of Supply	Consumption per day (STONS)
I (Subsistence)	53.6
II (Clothing, etc.)	26.1
III (POL)	See Note 1
IV (Construction Material)	68.0
V (Ammunition)	See Note 2
VI (Personal items)	25.6
VII (Major end items, e.g., tanks)	34.2
VIII (Medical material)	2.8
IV (Repair Parts)	12.2

Note 1. Class III -- Petroleum, Oil, Lubricants (POL) -- requirements are heavily dependent on whether the combat situation is static or highly mobile. Given below are the fuel requirements for the two conditions:

Static: 124.8 STONS / day

Displacement (50 km, combat conditions): 247.0 STONS / day

Note 2: Class V (ammunition) requirements depend on how heavily the unit is engaged in combat over a given period of time. A "worst case" situation is in the defense during the first three days of a high level commitment. Given below is the division's requirement for this particular combat situation.

Defense (high level) 1659.9 STONS / day

Source: Department of the Army, Staff Officers' Field Manual: Organizational, Technical and Logistic Data, FM 101-10-1 July 1976).

The total supply needs of the armored division comes to 2129.4 STONS, if the 50 km displacement is used for calculating POL requirements. Ammunition and POL account for 89 percent of the total requirement. However, the ammunition and POL percentages go up even further when non-critical or difficult to airlift supply classes are eliminated. Excluding classes IV (construction), VI (personal items), and VII (major end items) reduces the division's total supply requirement to 2001.6 STONS. To airlift this tonnage, if normal ACLs are used, will require approximately 103 C-130 or 65 AMST sorties. This assumes the payloads are weight and not volume limited, and suitable airfields are available within the encircled division's area. These assumptions are rarely valid and more sorties will probably be required to resupply the division. However, further examination of airlifting the division's supply requirements will not be made, since aerial resupply will probably be made directly to brigade or smaller size units. Therefore the resupply of a "typical" armor brigade will be explored in detail.

Armored Brigade

A brigade has no set organization but is created according to need from the division's maneuver battalions, combat support and combat service support elements.

To establish resupply requirements, a brigade consisting of two tank and two mechanized infantry battalions plus support elements will be used. For one brigade this is a relatively large number of maneuver battalions since a division only has six tank and five mechanized infantry battalions to form three brigades and a reserve. However, four maneuver battalions for a heavily committed brigade is not unreasonable, although due to the number and types of battalions it probably does represent a "worst case" for supply requirements.

Given in Table 4.2 is the brigade's organization, including combat support and combat service support elements.

Table 4.2 Armored Brigade

Unit	Personnel	Units	Total Personnel
Tank Battalion (Tk Bn)	548	2	1096
Infantry Battalion, Mech. (Mech Bn)	880	2	1760
Field Artillery Battalion (FA Bn) 155-mm, Self-Prop	541	1	541
Headquarters and Headquarters Company (HHC)	111	1	111
Forward Communications Platoon (Fwd Comm Plt)	54	1	54
Combat Engineer Company (Cbt Engr Co)	153	1	153
Air Defense Artillery Battery (ADA Btry), Vulcan, Self-Prop.	108	1	108
Military Police Platoon (MP Plt)	31	1	31
Forward Support Company, Maint. (Fwd Spt Co)	179	1	179
Medical Company (Med Co)	82	1	82
			4115

Source: Department of the Army, Staff Officers' Field Manual: Organizational, Technical and Logistic Data, FM 101-10-1 (July 1976).

The two Division Support Command (DISCOM) Units -- Fwd Spt Co and Med Co (Table 4.2) -- are needed by the brigade even in an encirclement situation. Other DISCOM units that may be with the brigade at the time of encirclement will probably be evacuated as soon as possible.

Based upon the size of the brigade, 4115 men, the supply requirements can be determined for class I (subsistence), class II (clothing and individual equipment), class XIII (medical supplies) and class IX (repair parts). The amount of supplies required by the brigade within these classes is shown in Table 4.3

Table 4.3 Brigade's Daily Supply Requirements (Excluding Fuel and Ammunition)

Class	Consumption Rate (lbs/man)	Total (STONS)
I (Subsistence)	6.70	13.8
II (Clothing, etc)	3.26	6.7
VIII (Medical)	0.35	0.7
IX (Repair parts)	1.52	3.1

Source: Department of the Army, Staff Officers' Field Manual: Organizational, Technical and Logistic Data, FM 101-10-1 (July 1976) p. 3-4.

Classes IV (construction material), VI (personal items) and VII (major end items) are not applicable to an encirclement

situation and are not considered. Class III (POL) and class V (ammunition) requirements are calculated using the different types of maneuver and support units and the combat situation.

The brigade's class III needs are dependent upon the amount of movement required. Even in a static situation fuel is required for auxilary equipment, such as generators, air-compressors and refrigerators, and to move vehicles within the perimeter. Table 4.4 provides fuel requirements for the brigade, both during a static condition and a 50 km combat move.

To calculate class V (ammunition) requirements the "worst case" is assumed. That is the ammunition consumption is based upon the highest commitment level and the most intensive type of combat operation. Under these conditions the heaviest demand is during the first three days of a defensive battle. This particular scenario may be very close to the truth for an encircled brigade. The daily ammunition requirement for the brigade engaged in this type of combat is given in Table 4.5.

If all of the supply classes are totalled, the brigade's supply needs come to 554.3 STONS per day with the total consisting of 24.3 STONS of subsistence, clothing, medical supplies and repair parts (Table 4.3), 102.8 STONS of fuel (Table 4.4, Displacement value) and 427.2 STONS of ammunition (Table 4.5). This assumes a daily 50 km displacement which may be realistic for an encircled brigade making a breakout. If a static combat situation is to be

Table 4.4 Brigade's Fuel Requirements

Units	Static		Displacement (50Km)	
	MO (Gals)	DF (Gals)	MO (Gals)	DF (Gals)
2 - Tk Bns:	1,860.8	6,001.6	3,272.4	14,107.0
2 - Mech Bns:	1,774.4	1,763.2	1,842.4	5,527.4
FA(155) Bn:	812.8	694.4	110.0	2,530.0
H H C	508.0	113.6	68.7	288.7
Fwd Comm Plt	252.4	29.0	127.0	22.7
Cbt Engr Co.	421.6	766.4	13.7	742.5
ADA Btry	163.2	155.2	27.5	646.2
MP PH	37.4	26.4	46.2	6.6
DISCOM	715.2	316.0	302.4	481.2
Totals	6,545.8	9,865.8	5,801.6	24,352.3

Static Requirements in STONS per Day

MOGAS: 6,545.8 gals x 0.0030 STONS/gal = 20.0 STONS

Diesel Fuel: 9,865.8 gals x 0.0035 STONS/gal = 34.5 STONS

Displacement Requirements (50 Km) in STONS per Day

MOGAS: 5,810.6 gals x 0.0030 STONS/gal = 17.7 STONS

Diesel Fuel: 24,352.3 gals x 0.0035 STONS/gal = 85.1 STONS

Source: Department of the Army, Staff Officers' Field Manual: Organizational, Technical and Logistic Data FM 101-10-1 (July 1976) pp 3-26, 3-27, 3-37.

Table 4.5 Brigade's Ammunition Requirements Per Day in STONS
(Heavy Defense Commitment During Initial Three Day Period)

Weapon	2-Tk Bns	2-Mech Bns	FA Bn	HHC	Fwd Comm Plt	Cbt Engr Co	ADA Btry	MP Plt	DISCOM	Total STONS per Weapon
Launcher, grenade, 40mm	0.25	1.15	0.35	0.02		0.13	0.11		0.03	2.[illegible]
Rocket, M202, 66mm	0.42	0.76								1.18
Machine gun, 0.50 cal.	2.73	13.22	2.24	0.21		0.61	0.27		0.03	19.31
Machine gun, 7.62mm		3.53	1.15		0.05	0.10	0.14		0.10	5.07
Mortar, 81mm		13.32								13.32
Mortar, 4.2 in.	15.36	15.36								30.72
Rifle, 5.56mm	0.98	2.65	0.93	0.16	0.10	0.26	0.19	0.06	0.45	5.78
Machine gun, 0.45 cal.	0.18	0.02								0.20
Tank, 105mm	155.88									155.88
Howitzer, 155mm			157.80							157.80
A.A. gun, 20mm							20.80			20.80
TOW msl.		15.12								15.12
Total STONS per Unit	175.80	65.13	162.47	0.39	0.15	1.10	21.51	0.06	0.61	427.22

Source: Department of the Army, Staff Officers' Field Manual: Organizational, Technical and Logistic Data FM 101-10-1 (July 1976).

maintained then the total daily requirement reduces to 506.0 STONS.

Looking at the brigade's needs by class of supply, ammunition and fuel are the two commodities in greatest demand. Together ammunition and fuel account for over 95 percent of the brigade's daily needs, whether it is moving or not. Ammunition alone accounts for 77 percent of total supply requirement. With ammunition and fuel forming such a large percentage of the brigade's requirements, the airlift analysis is simplified, although it may not simplify the actual airlift task.

AIRLIFT REQUIREMENTS

The number of sorties required to deliver the brigade's 554.3 STONS of supplies depends upon several factors; attrition due to enemy action; whether the cargo is weight or volume limited; distance from departure airfield to encircled unit; characteristics and availability of runways; and the capabilities of the airlift aircraft used. The first factor, attrition, was discussed in Chapter IV and will not be addressed here. Whether the cargo is weight or volume limited does not have any significant impact on sorties in an encirclement situation, since most, if not all, of the supplies airlifted to the encircled brigade are weight limited. The distance factor used in this analysis is approximately 400 NM, i.e., the distance between RAF Mildenhall, England, and the Fulda Gap area of Southern Germany. This distance is well within the range of the

C-130 and AMST. The capabilities of the aircraft -- C-130 and AMST -- and the impact caused by the characteristics or availability of runways are the only factors left for examination. Using the number of C-130 and AMST sorties needed to airlift the brigade's supplies, a comparison will be made between airland and aerial delivery methods. This sortie comparison will also address the impact of runways since their availability and suitability determines whether airland or aerial delivery is used.

Airland

The availability of existing runways in the U.S. Army's area of responsibility in West Germany restricts the delivery of normal ACLs to only a few of the 29 airfields; the C-130 (39,100 lbs) can land at 5 airfields and the AMST (62,000 lbs) at 7. At payloads below their normal ACL, both aircraft can use additional airfields. However, the AMST using its STOL payload of 27,000 pounds can use 26 airfields or 90 percent of the total. For this analysis, sorties are determined from normal or AMST STOL payloads only.[2]

Another consideration that affects the number of sorties is the packaging of fuel. Usually bladders are used which normally restricts delivery of fuel to increments of 500 gallons or 3250 pounds (approximately 6.5 lbs per gal). At normal ACLs the C-130 can carry 12 bladders and the AMST, 19. Using its STOL payload the AMST can carry 8.

To resupply the brigade with its total daily requirement of 554.3 STONS, either 29 C-130 or 18 AMST sorties

using normal ACLs will be needed. The 5,810 gallons of MOGAS and 24,352 gallons of diesel fuel will require 5.1 C-130 or 3.2 AMST sorties. The ammunition and remaining supplies will use 23.1 C-130 or 14.6 AMST sorties. However this minimum number of sorties will be realized only if the brigade possess one of the few airfields with long runways. A greater likelihood is that only a short runway will be available and if this happens then the sortie numbers go up.

The AMST using a 2,000 foot runway (STOL minimum) will need 7.6 sorties for fuel and 33.4 sorties for the remaining supplies. Thus the AMST needs a total of 41 sorties to resupply the brigade if the available runway restricts the aircraft to STOL operations. If no runways are available then aerial delivery methods will have to be used.

Aerial Delivery

The three primary methods of aerial delivery are CDS and heavy platform airdrops and the low-altitude extraction method called LAPES. Each one has advantages and disadvantages. CDS provides small containers that allow for easy portability on the ground, but requires a large number of A-22 containers and parachutes. A heavy platform drop may require less support equipment but the large supply containers and fuel bladders may be harder to handle on the ground. LAPES offers high accuracy in delivery but requires support equipment that is not always plentiful.

Again fuel, due to unique packaging requirements, has to be considered separately from ammunition and other supplies.

For delivering fuel via the CDS method four 55 gallon drums can be packed in one A-22 container. This means a total of 139 A-22 containers is required for the brigade's fuel requirements, 28 containers for MOGAS and 111 containers for diesel fuel. For both heavy airdrop and LAPES, three 500-gallon bladders can be secured to one platform. Since 61 bladders are required to deliver the brigade's fuel, a total of 21 platforms is needed.[3]

The remaining 451.5 STONS of supplies require either 411 A-22 containers, 25 heavy drop platforms, or 25 LAPES platforms. Therefore a total of 550 A-22 CDS containers, or 46 heavy platforms, or 46 LAPES platforms can handle the brigade's daily supply requirement. However, the platforms used for fuel, ammunition, and other supplies do not equate to the same weight and size, e.g., a C-130 can airlift three fuel-loaded platforms (approximately 30,000 lbs) versus one platform loaded to its maximum weight with ammunition (36,700 lbs).

For CDS airdrops the C-130 can carry 16 A-22 containers and requires 35 sorties to airlift the brigade's daily requirement of 550 containers. The AMST only requires 25 sorties to airlift the brigade's requirement, since it carries 22 A-22 containers per aircraft.

Using heavy platform airdrops or LAPES the C-130 requires 32 sorties to supply the brigade. Fuel requires 7 sorties and 25 are needed for ammunition or other supplies. The particular capability of the AMST to airlift heavy platform or LAPES is still uncertain. MAC's Required

Operational Capability ROC MAC 75, Advanced Medium STOL Transport calls for a minimum capability of 40,000 pounds and a desired capability of 50,000 pounds. If the desired payload is achieved, then the AMST can accomplish the heavy airdrop or LAPES mission by using approximately 27 percent less sorties than the C-130.

SUMMARY

An armored unit's resupply needs are large, more than any other equivalent size unit. An encircled armored brigade, consisting of two tank and two mechanized infantry battalions plus support elements, requires approximately 554.3 STONS of supplies per day. Over 95 percent of this daily requirement consists of ammunition and fuel, with subsistence items accounting for less than three percent. However, ammunition, and fuel, if bladders are readily available, can be airlifted efficiently. That is, due to their high densities and ability to be incremented into small lots, they can be easily loaded on either the C-130 or the AMST up to the aircraft's permissible ACL.

In the resupply of an encircled brigade the AMST has significant advantages over the C-130. Where airfields allow normal ACLs to be used, the AMST needs 38 percent fewer sorties than the C-130 (Table 4.6) and the AMST's 30 percent speed advantage means the sorties are conducted at a faster rate. Probably more important to an encircled unit is the AMST's STOL capability. In the area of West Germany where the U.S. Army is presently located, the C-130 can use

approximately 24 percent of the available airfields, and some of these only with reduced payloads, while the AMST can use 90 percent. The ability of the AMST to conduct airland operations, where otherwise it may not be possible, is important for more reasons than just efficiency in the delivery of supplies. Backhaul capability is critical to an encircled unit. Probably the most important requirement is the evacuation of wounded and nonessential personnel. Also, the potential to return valuable but damaged equipment is an asset.

Table 4.6 Daily Sorties Required to Resupply the Brigade

Aircraft	Airland (Normal)	STOL	CDS	Heavy Platform	LAPES
C-130	29	NA	35	32	32
AMST	18	41	25	24*	24*

NA: Not applicable
* Estimated

Where suitable airfields are not available, aerial delivery methods have to be used. The number of sorties needed to complete the brigade's resupply requirements via aerial delivery is not much more than by using airlandings (Table 4.6). However, if the resupply effort continues over a long period, the amount of expended support materials (parachutes, platforms and containers) may become prohibitive.

Regardless of the delivery methods used, airland or

aerial delivery, the number of daily sorties needed to resupply a brigade size unit is not many, especially if the AMST is available (Table 4.6). The tactical airlift forces available to NATO during a conflict will easily have the airlift potential to carry out the task. However, as with any limited resource, the Joint Commander's allocation of airlift sorties may well decide how many and what size units may be resupplied by air.

ENDNOTES

1. "U.S. Army, Europe," _Army_ (October 1976), p. 139.

2. U.S. Army Transportation School, _Army Utilization of the Advanced Medium STOL Transport (AMST) Capabilities (Final Draft)_ (July 1976), p. 6-2, 3.

3. Statement by Robert L. Reed (Equipment Specialist, Aerial Delivery, Airborne, Communications and Electronics Board), personal interview, March 29, 1977.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY AND CONCLUSIONS

The aerial resupply of an encircled army unit during a NATO versus Warsaw Pact conflict will be a demanding task. The challenges posed by weather, Soviet anti-air threat, and resupply requirements are severe.

In the V and VII Corps areas of West Germany, weather conditions during the fall and winter require the resupply aircraft to have an all-weather capability. During these seasons cloud ceilings of 500 feet, or less, exist for 18 percent of the time, and during January visibility is below 2 miles for 35 percent of the time. Presently, approximately 20 percent of the active duty C-130s are equipped with AWADS, giving the tactical airlift forces a limited all-weather aerial delivery and airland capability. In the future with the advent of GPS, the accuracy of all-weather aerial deliveries will be significantly improved (CARP determinations of 30 meters or less), and when coupled with the AMST, an all-weather STOL capability may be realized. This latter capability, all-weather STOL, will permit the AMST to use rudimentary airfields to resupply encircled forces during almost any weather condition.

The Soviet anti-air threat will present a greater

challenge to aerial resupply than weather. Within a Soviet tactical army, an array of lethal AAA and SAMs are available to engage resupply aircraft. In addition, the Soviets have over 2,500 modern fighters assigned to their tactical air force that can also be used to destroy the ALOC. Against this formidable threat the U.S. Air Force is developing, or has deployed, a number of new weapon systems. For example, PELSS, RPVs, ECM and IRCM equipment are being developed to be used against SAMs and AAA, and AWACS and F-15 fighters are available to counter the Soviet fighter threat. With these new weapons, the NATO air forces, and particularly the U.S. Air Force, may be able to create a survivable environment for airlift aircraft over the battlefield. However, the creation of a completely benign environment is improbable and the survivability characteristics of the airlift aircraft are important. To survive in a hostile environment the AMST will be much better equipped than the C-130. The AMST will have a 30 percent speed advantage, IRCM equipment, probable ECM pods, and limited armor. With these additional advantages the AMST will be able to conduct resupply operations where the C-130 cannot.

When considering resupply requirements, the AMST will also possess airlift advantages over the C-130. When resupplying a "typical" armored brigade using normal airland operations (normal ACLs), the AMST will require 38 percent fewer sorties than the C-130. To resupply the brigade using aerial delivery methods, the AMST will require during CDS operations 28 percent fewer sorties and approximately 25

percent fewer sorties for heavy platform airdrop and LAPES operations. However, the primary advantage of the AMST will be its STOL capability. Of the 29 airfields available in the V and VII Corps areas, the AMST will be able to use 90 percent whereas the C-130 can use only 24 percent. The STOL capability will be critical to the encircled unit. It is imperative that the wounded and nonessential personnel be evacuated.

In all three areas that have been examined -- weather, Soviet anti-air threat, and airlift requirements -- the AMST provides a significant advantage over the C-130. In a mid-intensity conflict, the advantages offered by the AMST may provide the difference between success and failure. However, in many situations, if adequate protection is provided by supporting tactical air forces, aerial resupply of encircled army units will be possible using either the C-130 and/or AMST.

RECOMMENDATIONS

This study has attempted to answer the basic questions put forth in Chapter I. However, many times the answers are situation dependent, e.g., enemy threat, weather conditions during a particular operation, airfield availability and suitability, adequate quantity of airdrop or LAPES support equipment, and airlift requirements of particular units. Even though the basic questions can not be fully answered, some potential problem areas are easily recognized. Better all-weather equipment is needed and

aircraft survivability characteristics require constant improvement. Also, aircrew proficiency may be a problem, if a sufficient number are not fully qualified. Listed below are some recommendations that address these problem areas.

- Continue the research for more suitable ECM, IRCM, and armored protection for airlift aircraft.

- Develop the full potential of the GPS navigational capability in both the C-130 and AMST.

- Maintain a majority of tactical airlift crews fully qualified in all aerial delivery and STOL procedures. In a mid-intensity war the full capabilities of everyone will be needed immediately.

- Have a majority of the tactical airlift crews undergo training with supporting tactical air force elements (AWACS, counter-air fighters, ECM aircraft) against a simulated threat. For example, the Tactical Air Command's Red Flag facility provides Soviet air defense threats that can be used for this type of training.

The two areas that these recommendations affect -- adequate equipment and aircrew training -- are paramount in the ability of the U.S. Air Force to perform one of the most difficult of all airlift missions -- the aerial resupply of an encircled unit.

APPENDIXES

APPENDIX A

YC-14 AND YC-15 AIRCRAFT

As part of the Advanced Medium STOL Transport (AMST) program the U.S. Air Force on 10 November 1972 selected Boeing Aerospace and McDonnell Douglas to construct and flight test two prototype aircraft. The McDonnell Douglas, YC-15, first flew on 26 August 1975 and completed its flight test program within a year. The Boeing, YC-14, conducted its first flight on 9 August 1976 and is presently undergoing flight test. At present, source selection is scheduled for the fall of 1977. This will provide an initial operational capability by December 1983.

YC-14

The Boeing, YC-14, attains STOL performance by using a unique feature called Upper Surface Blowing (USB). By using USB additional lift is produced by jet engine exhaust passing over a supercritical wing and flap system. The aircraft is powered by two General Electric YF-103-GE-100, turbofan engines, each rated at 51,000 lbs. The dimensions and performance characteristics of the YC-14 are given below.[1]

<u>Dimensions, External:</u>

Wing Span	129 ft 0 in
Length overall	131 ft 8 in
Height overall	48 ft 4 in

Dimensions, Internal (Cargo Compartment):

Length	47 ft 4 in
Max width	11 ft 8 in
Height at front	11 ft 2 in
Height at rear	12 ft 0 in

Weights and Loading:

Operating weight empty	124,000 lbs
Payload for STOL mission	27,000 lbs
Max payload	81,000 lbs

Performance (STOL payload except where noted):

Max level speed at Sea Level (S/L)	350 knots
Max speed at 30,000 ft	468 knots
Long range cruising speed	390 knots
Approach speed	86 knots
Rate of climb at S/L	3,250 ft/min
Rate of climb at 5,000 ft	6,000 ft/min
Service ceiling	45,000 ft
Takeoff field length, S/L at 15°C	1,730 ft
Landing field length, S/L at 15°C (idle reverse)	1,825 ft
Mission radius (STOL)	400 NM
Range with max payload (81,000 lbs)	1,000 NM
Range with 38,000 lbs payload and external tanks	2,600 NM
Ferry range without external tanks	2,700 NM

YC-15

The McDonnell Douglas, YC-15, uses a supercritical wing and an externally blown flap powered-lift system to

achieve STOL performance. Jet exhaust is passed through the flap system to produce additional lift. The aircraft is powered by four Pratt and Whitney, JT8D-17, turbofan engines, each rated at 16,000 lbs. The YC-15's dimensions and characteristics are given below.[2]

Dimensions, External:

Wing span	110 ft 4 in
Length overall	124 ft 3 in
Height overall	43 ft 4 in

Dimensions, Internal (Cargo Compartment):

Length	47 ft 0 in
Max width	11 ft 8 in
Max height	11 ft 4 in

Weights and Loading:

Max takeoff weight	216,680 lbs
Payload for STOL mission	27,000 lbs
Max payload	62,000 lbs

Performance (estimated):

Max level speed	434 knots
Approach speed	85 knots
Takeoff field length (STOL payload)	2,000 ft
Landing field length (STOL payload)	2,000 ft
Mission radius (STOL)	400 NM
Ferry range	2,600 NM

ENDNOTES

1. "Jane's All the World's Aircraft Supplement, Boeing AMST," Air Force Magazine (February 1977), pp. 77-80.

2. "Jane's All the World's Aircraft Supplement, McDonnell Douglas YC-15," Air Force Magazine (December 1975), pp. 107-108.

APPENDIX B

CLIMATIC BRIEFS

SELECTED WEST GERMAN AND ENGLISH AIRFIELDS

BEST AVAILABLE COPY

AWS CLIMATIC BRIEF

Prepared by ETAC (JUN 70) | FRANKFURT MAIN, RHEIN MAIN APT, GERMANY | N 50 02 E 08 34 | PERIOD 1946-63 | ELEVATION 378 ft | WBAN # 35032 | WMO # 10637 | STN LTRS EDAF

MONTH	TEMPERATURE (°F) Extreme Maximum	Mean Daily Maximum	Mean Daily Minimum	Extreme Minimum	PRECIPITATION (in) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme Speed (Max Wind)	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01	Precip ≥ 0.5 in	Snowfall ≥ 0.1 in	Snowfall ≥ 1.5 in	Thunderstorms	Fog (< Miles)	Temperature (°F) Maximum ≥	Maximum ≥	Minimum ≤	Minimum ≤	Mean Clouds (Tenths)
JAN	60	37	28	-1	1.7	0.7	5	9	SW	8	48	88	80	28	.15	1300	14	#	4	1	1	19	0	0	20	#	8
FEB	64	39	28	-4	1.4	1.3	3	4	NE	7	40	88	74	28	.15	1400	12	#	3	1	2	18	0	0	19	#	7
MAR	74	51	33	9	1.4	0.9	1	4	NE	7	35	87	62	33	.19	1250	10	#	1	#	1	17	0	0	15	0	6
APR	87	60	40	20	1.6	1.0	#	2	NE	7	26	86	55	39	.24	1050	12	1	#	#	2	11	0	#	5	0	6
MAY	89	67	46	27	2.5	1.8	#	#	NNE	7	36	87	54	45	.30	800	13	1	0	0	4	13	0	2	1	0	6
JUN	97	73	52	32	2.9	4.2	#	#	SW	6	25	89	54	52	.39	800	12	2	0	0	6	13	1	6	#	0	6
JUL	100	76	56	38	2.5	2.0	0	0	SW	6	35	89	54	55	.43	750	12	1	0	0	5	12	2	10	0	0	6
AUG	96	75	55	38	3.4	5.4	0	0	SW	6	35	91	56	54	.42	800	13	1	0	0	6	14	1	8	0	0	6
SEP	93	69	50	32	1.9	1.2	0	0	SW	6	30	92	61	51	.37	800	11	1	0	0	4	17	1	3	#	0	6
OCT	80	58	41	21	1.8	1.6	#	#	SW	6	28	93	69	44	.29	950	10	1	0	0	3	22	0	#	4	0	6
NOV	63	46	36	11	2.0	0.9	1	4	SW	6	30	92	79	37	.22	1250	14	1	1	#	2	21	0	0	9	0	8
DEC	60	38	30	1	2.1	1.1	3	10	SW	7	44	91	83	31	.17	1400	13	1	2	#	2	22	0	0	18	#	8
ANN	100	57	41	-4	25.0	5.4	13	10	SW	7	48	89	65	42	.27	1100	146	10	11	2	38	199	5	29	91	#	7
EYR	17	17	17	17	16	16	17	17	17	17	10	17	17	17	17	17	16	16	17	17	17	17	17	17	17	17	17

REMARKS

RUSSWO POR: Hourly Obs: Sep 46 - Dec 63
Daily Obs: Sep 46 - Dec 63

NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG Less Than 3000 Feet and/or VSBY Less Than 3 Miles	00-02	52	53	34	16	10	12	11	14	27	48	59	66	34	
	03-05	56	54	38	27	26	25	26	28	42	57	61	68	42	
	06-08	65	64	54	31	21	22	24	29	50	70	69	75	48	
	09-11	66	61	41	23	16	15	15	17	31	53	64	74	40	
	12-14	57	51	27	16	10	9	8	7	16	34	53	65	29	
	15-17	56	47	20	9	6	6	5	5	10	28	52	63	26	
	18-20	52	47	22	10	5	7	6	7	12	32	50	61	26	
	21-23	52	50	24	11	6	8	7	8	17	40	56	65	29	
	ALL HOURS	57	53	33	18	12	13	13	14	26	45	58	67	34	17
CIG Less Than 1500 Feet and/or VSBY Less Than 3 Miles	00-02	35	39	23	8	6	8	6	10	22	42	42	45	24	
	03-05	36	39	27	17	19	20	20	22	36	48	44	46	31	
	06-08	45	52	44	23	15	14	16	21	44	62	53	54	37	
	09-11	49	50	29	10	5	5	5	8	20	43	49	57	28	
	12-14	39	38	15	3	2	3	2	2	7	24	35	47	18	
	15-17	38	36	11	2	1	2	1	2	6	21	35	48	17	
	18-20	35	35	15	4	2	3	2	3	8	25	33	45	18	
	21-23	37	37	18	5	3	5	4	4	14	33	39	46	20	
	ALL HOURS	39	41	23	9	7	7	7	9	20	37	41	48	24	17
CIG Less Than 1000 Feet and/or VSBY Less Than 2 Miles	00-02	24	26	12	4	3	5	3	5	15	30	28	33	16	
	03-05	24	26	17	11	11	12	12	15	26	37	31	34	21	
	06-08	33	38	31	13	7	8	8	13	32	51	30	40	25	
	09-11	36	38	17	4	3	2	2	4	11	30	36	44	19	
	12-14	29	27	7	1	1	1	1	1	3	16	24	35	12	
	15-17	26	26	7	1	#	1	1	1	2	14	24	35	12	
	18-20	22	25	8	1	1	1	1	1	5	17	23	30	11	
	21-23	24	26	10	2	1	3	2	2	7	23	26	32	13	
	ALL HOURS	27	29	14	5	3	4	4	5	13	27	29	35	16	17
CIG Less Than 200 Feet and/or VSBY Less Than 1/2 Mile	00-02	4	6	2	1	1	1	#	1	3	10	6	9	4	
	03-05	5	7	4	2	2	1	2	2	7	14	8	10	5	
	06-08	5	8	5	2	1	1	1	2	8	18	9	11	6	
	09-11	6	7	2	#	0	0	#	#	1	8	6	9	3	
	12-14	4	3	#	0	0	0	0	0	0	1	2	6	1	
	15-17	4	3	1	0	0	#	0	0	0	1	2	7	2	
	18-20	3	4	1	#	0	0	0	#	#	3	3	6	2	
	21-23	4	6	1	#	#	0	#	#	#	7	5	7	3	
	ALL HOURS	4	6	2	1	#	#	#	1	2	8	5	8	3	17

AWS CLIMATIC BRIEF — FULDA AAF, GERMANY — PERIOD 1960-70[1] — WBAN # 35053 — WMO # — STN LTRS EDEX

Prepared by ETAC (APR 1972) — N 50 33 E 09 39 — FIELD ELEVATION 1000 ft

MONTH	TEMPERATURE (°F) Extreme Maximum[2]	Mean Daily Maximum	Mean Daily Minimum	Extreme Minimum[2]	PRECIPITATION (in) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Peak) (Gust) Speed	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01 in	Precip ≥ 0.5 in	Snowfall ≥ 0.1 in	Snowfall ≥ 1.5 in	Thunderstorms	Fog (< 7 miles)	Temperature (°F) Maximum ≥ 90	Maximum ≥ 80	Minimum ≤ 32[3]	Minimum ≤ 0	Mean Clouds (Tenths)
JAN	54	37	31	-9	1.3	0.6	11	4	SSW	6	36	90	84	27	.15	1900	18	1	12	2	1	22	0	0	20	1	9
FEB	60	38	28	-5	2.5	1.2	4	6	SSW	6	50	88	79	28	.15	2000	13	2	3	1	2	14	0	0	17	#	8
MAR	74	48	36	1	2.2	0.6	2	3	SW	7	44	87	71	31	.17	1850	17	#	3	#	2	15	0	0	12	0	7
APR	86	53	36	23	2.5	1.2	1	1	SW	6	44	88	63	38	.23	1750	17	#	3	0	#	17	0	#	6	0	8
MAY	84	64	45	29	2.6	0.8	#	#	SW	6	42	89	59	44	.29	1500	15	1	#	0	4	13	0	1	1	0	7
JUN	88	68	50	31	3.3	2.3	0	0	SW	5	38	92	58	51	.38	1350	16	2	0	0	6	16	0	3	#	0	7
JUL	92	72	53	37	3.4	1.2	0	0	SW	5	42	92	58	53	.40	1400	14	2	0	0	6	18	#	8	0	0	7
AUG	94	70	50	37	2.9	1.5	0	0	SW	5	60	94	61	53	.40	1400	15	2	0	0	6	20	#	2	0	0	7
SEP	88	64	47	29	1.6	1.1	0	0	SSW	5	32	94	66	50	.36	1550	12	#	0	0	2	22	0	1	1	0	7
OCT	80	58	41	23	1.3	0.8	0	0	SSW	5	52	94	75	45	.30	1650	12	#	0	0	#	23	0	#	7	0	7
NOV	66	40	31	11	2.6	1.1	8	5	SSW	6	39	91	83	35	.20	2000	17	1	6	2	2	21	0	0	10	0	9
DEC	58	38	31	-7	4.7	1.4	6	4	SSW	6	40	89	85	28	.15	2100	21	4	9	2	#	25	0	0	18	#	9
ANN	94	54	40	-9	30.9	2.3	32	6	SSW	6	60	91	70	40	.25	1750	187	15	36	7	31	226	#	14	92	1	8
EYR	10	4	4	10	6	6	6	5	10	10	5	10	10	10	10	9	6	6	6	6	3	3	10	4	4	10	10

REMARKS

1 Less than full time operation.
2 Extremes of 2°F class interval.
3 Estimated from nearby station.

RUSSWO FOR: HRLY OBS: 6009-7012; DAILY OBS: 6009-10, 6101-03, 6307-6502, 6505-11, 6601-7012.

NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02	61	46	41	27	10	11	14	12	26	33	66	55	34	3
	03-05	68	54	52	43	32	37	38	43	57	60	66	66	51	9
	06-08	69	64	62	53	40	38	37	51	64	67	65	70	57	10
	09-11	75	69	58	48	34	27	26	35	55	61	65	74	52	10
	12-14	70	59	47	40	23	19	18	19	25	40	60	70	41	10
	15-17	62	52	37	29	14	12	12	11	12	30	52	69	33	10
	18-20	63	51	32	23	7	10	7	5	10	27	53	70	30	10
	21-23	54	41	27	19	6	7	8	5	12	20	59	64	27	3
	ALL HOURS	63	58	48	39	24	22	22	26	36	46	60	70	43	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	40	23	19	12	3	7	7	10	22	24	51	35	21	3
	03-05	54	38	35	31	21	27	30	36	51	49	52	50	40	9
	06-08	56	50	45	41	29	29	30	42	57	56	51	54	45	10
	09-11	63	55	43	28	14	11	12	19	40	49	50	60	37	10
	12-14	55	42	26	13	8	5	5	6	12	25	42	56	25	10
	15-17	43	35	18	9	3	3	4	3	[illegible]	17	38	54	19	10
	18-20	45	33	18	9	2	3	3	2	6	17	40	55	19	10
	21-23	42	23	9	12	2	2	4	1	9	13	46	40	17	3
	ALL HOURS	52	42	30	21	12	12	13	17	27	34	46	54	30	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02	26	10	11	7	2	4	5	5	17	19	41	18	14	3
	03-05	38	28	21	21	16	20	25	27	43	41	40	33	29	9
	06-08	40	36	29	30	21	18	21	32	47	47	37	41	33	10
	09-11	43	39	26	15	7	6	6	12	28	37	36	44	25	10
	12-14	35	28	13	6	4	2	1	2	4	14	26	40	15	10
	15-17	29	20	8	3	2	1	1	1	2	10	26	38	12	10
	18-20	30	21	9	3	1	#	1	1	3	9	26	40	12	10
	21-23	19	11	5	2	0	0	2	0	4	11	30	19	9	3
	ALL HOURS	35	28	17	12	7	7	8	11	20	25	32	38	20	
CIG less than 200 feet and/or VSBY less than ½ mile	00-02	3	2	2	1	1	2	3	2	8	12	14	3	4	3
	03-05	7	4	3	6	7	8	7	3	28	27	13	4	10	9
	06-08	8	9	6	11	7	6	6	14	32	31	13	6	12	10
	09-11	7	9	3	3	#	0	#	2	10	18	10	7	6	10
	12-14	4	2	#	0	0	0	#	0	0	2	4	5	1	10
	15-17	3	3	#	#	0	0	0	0	0	1	5	4	1	10
	18-20	3	1	0	#	#	0	0	0	1	2	7	4	2	10
	21-23	2	1	0	0	0	0	0	0	2	4	11	1	2	[illegible]
	ALL HOURS	5	5	2	3	2	2	2	4	11	13	9	5	5	

BEST AVAILABLE COPY

AWS CLIMATIC BRIEF — HANAU AAF/LANGENDIEBACH, GERMANY — PERIOD 1946-67B — WBAN # 35009, WMO # 10642

Prepared by ETAC ([illegible] 1971) — N 50 10 E 08 58 — ELEVATION: 377 ft — STN LTRS [illegible]DID

MONTH	TEMPERATURE (°F): Extreme Maximum [1]	Mean Daily Maximum [3]	Mean Daily Minimum [3]	Extreme Minimum [1]	PRECIPITATION (in): Mean Total [3]	Maximum in 24 Hours [3]	Mean Snowfall [3]	Max Snowfall in 24 Hours [3]	WIND (KT): Prevailing Direction	Mean Speed	Extreme Speed (Max Wind) [2]	MEAN: Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude 99.95% (Feet)	MEAN NUMBER OF DAYS [3]: Precip ≥ 0.01 in	Precip ≥ 0.5 in	Snowfall ≥ 0.1 in	Snowfall ≥ 1.5 in	Thunderstorms	Fog (< 7 Miles)	Temperature (°F) Maximum ≥ 90	Maximum ≥ 80	Minimum ≤ 32	Minimum ≤ 0	Mean Clouds (Tenths)
JAN	58	37	30	-5	*	*	3	1	SW	5	33	86	79	29	.16	1250	*	*	6	0	1	22	0	0	15	#	8
FEB	64	43	34	1	1.7	0.3	*	*	SW	5	33	84	75	32	.18	1500	14	0	*	*	0	16	0	0	13	0	8
MAR	72	48	35	9	1.5	0.4	3	3	SW	6	27	84	67	35	.20	1150	16	0	3	1	2	21	0	0	12	0	7
APR	80	58	42	23	3.0	0.5	#	#	SW	5	27	85	60	41	.26	1150	21	#	0	0	4	26	0	#	1	0	7
MAY	84	67	48	31	2.4	0.5	0	0	E	5	40	86	58	47	.32	850	15	#	0	0	6	17	0	2	#	0	7
JUN	94	71	54	37	5.0	2.2	0	0	SW	5	27	89	58	52	.39	800	14	3	0	0	7	17	#	7	0	0	7
JUL	98	72	55	39	3.4	1.4	0	0	SW	4	33	89	59	56	.45	750	16	2	0	0	6	19	1	6	0	0	7
AUG	96	74	54	41	1.6	0.5	0	0	SW	4	27*	90	61	55	.44	800	11	#	0	0	4	18	2	8	0	0	7
SEP	88	66	49	35	2.1	0.8	0	0	SW	4	33	90	63	51	.38	900	11	1	0	0	3	27	0	2	0	0	7
OCT	80	58	42	27	1.7	1.5	0	0	SW	4	33	91	72	45	.30	1050	9	1	0	0	1	28	0	#	3	0	7
NOV	70	44	36	15	3.7	1.8	4	3	SW	4	33	88	79	37	.22	1300	17	1	5	1	0	25	0	0	11	0	8
DEC	62	42	34	5	5.0	1.6	3	3	SW	5	33	86	81	32	.18	1500	23	2	4	1	0	23	0	0	10	0	8
ANN	98	57	43	-5	*	*	*	*	SW	5	40	87	68	43	.28	1100	*	*	*	*	34	259	3	25	65	#	7
EYR	11	2	2	11	2	2	2	2	12	12	12	12	12	12	12	11	2	2	2	2	2	2	2	2	2	2	11

REMARKS [1] Refers to highest and lowest hourly temperatures class interval.
[2] Refers to highest hourly wind speed class interval.
[3] Daily Obs POR differs from EYR because of incomplete months

POR: Hourly Obs: May - Aug 46, Oct 56 - Dec 67
Daily Obs: Feb - Aug 46, Oct 56 - Feb 64, Jun 64, Aug 64 - Dec 66

NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and / or VSBY less than 3 miles	00-02	60	37	31	22	14	19	16	10	38	43	60	53	34	5
	03-05	58	45	43	36	26	26	26	31	46	57	62	58	43	10
	06-08	58	56	50	38	29	27	27	33	48	61	63	65	46	12
	09-11	64	56	48	36	25	23	22	27	35	56	63	71	44	12
	12-14	56	50	37	26	19	18	16	17	21	39	58	64	35	12
	15-17	55	43	28	18	11	12	10	9	12	30	53	61	29	12
	18-20	57	36	23	15	8	11	7	6	16	36	58	62	28	11
	21-23	61	32	22	17	11	13	10	9	19	39	57	59	29	7
	ALL HOURS	58	47	38	27	19	19	17	19	29	46	59	63	37	
CIG less than 1500 feet and / or VSBY less than 3 miles	00-02	49	30	23	16	11	12	14	9	35	35	49	38	27	5
	03-05	48	35	29	27	20	21	22	27	44	48	52	43	35	10
	06-08	43	43	39	31	21	22	22	27	45	52	48	49	37	12
	09-11	51	46	26	23	12	12	11	14	27	46	48	55	32	12
	12-14	42	36	19	8	4	7	3	5	11	26	40	46	21	12
	15-17	41	28	13	3	3	4	2	3	6	20	37	46	17	12
	18-20	47	24	14	5	4	3	3	3	10	30	43	46	19	11
	21-23	48	21	15	12	6	8	6	6	17	31	46	42	22	7
	ALL HOURS	45	35	25	16	10	11	10	12	23	36	44	47	26	
CIG less than 1000 feet and / or VSBY less than 2 miles	00-02	19	15	6	5	2	7	6	6	20	19	25	22	13	5
	03-05	24	22	13	12	10	12	13	14	28	34	28	24	20	10
	06-08	27	31	22	15	10	11	12	14	29	40	30	30	23	12
	09-11	35	32	19	9	5	5	4	6	14	30	34	36	19	12
	12-14	29	22	8	2	2	4	1	2	4	14	23	28	12	12
	15-17	24	17	6	1	1	2	1	1	2	11	21	30	10	12
	18-20	28	14	7	1	1	1	1	2	5	18	24	31	11	11
	21-23	23	9	5	3	2	5	2	4	5	16	26	28	11	7
	ALL HOURS	28	23	12	6	4	6	5	6	13	23	26	30	15	
CIG less than 200 feet and / or VSBY ½ mile	00-02	0	3	1	1	1	1	1	2	2	5	3	3	2	5
	03-05	2	3	2	3	2	3	1	3	9	11	4	4	4	10
	06-08	3	8	4	4	2	2	2	3	10	17	6	5	6	12
	09-11	5	9	2	1	#	#	#	#	2	10	6	8	4	12
	12-14	5	4	#	0	0	0	0	0	0	2	2	5	2	12
	15-17	4	2	0	0	0	0	0	0	0	1	2	6	1	12
	18-20	3	2	0	0	0	0	0	0	#	4	3	6	2	11
	21-23	1	1	0	0	1	#	1	1	0	5	3	5	2	[illegible]
	ALL HOURS	3	5	1	1	1	1	1	1	3	7	4	5	3	

PREPARED BY: USAFETAC JUNE 1974 — STATION NAME: HEIDELBERG AAF GERMANY — LOCATION: N49 24 E008 39 — PERIOD: APR 51-JUL 72 — ELEV: 359 — STN LTRS: EDIE — WBAN NO: 34046 — WMO NO: 10734

AWS CLIMATIC BRIEF

MONTH	Temp. mean daily max (°F)	Temp. mean daily min	Temp. mean monthly	Temp. extreme max	Temp. extreme min	Precip. monthly mean (in)	Precip. monthly max	Precip. monthly min	Precip. max 24 hrs	Snowfall monthly mean (in)	Snowfall monthly max	Snowfall max 24 hrs	Mean rel. humidity (%) 03 LST	Mean rel. humidity (%) 12 LST	Mean vapor pressure (in Hg)	Mean dew pt (°F)	Pressure altitude (ft)	Sfc winds prvlg drctn	Sfc winds mean speed (kt)	Sfc winds max speed (kt) **	Cloud cover (tenths)	Precip ≥ 0.01	Precip ≥ 0.5	Snowfall ≥ 0.1	Snowfall ≥ 1.5	Thunderstorms	Fog vsby < 7/8	Temp max ≥ 90	Temp max ≥ 80	Temp min ≤ 32	Temp min ≤ 0
JAN	35	29	34	58	0	1.8	4.3	.6	1.0	3	11	7	88	81	.16	29	1250	35	5	45	8	13	1	3	1	*	20	0	0	17	*
FEB	41	30	36	67	-6	1.8	3.3	.4	1.2	3	15	8	86	76	.17	30	1400	35	5	45	8	13	1	3	1	*	17	0	0	16	*
MAR	51	35	43	77	14	1.6	3.9	.3	1.0	2	10	7	84	63	.20	33	1150	35	5	52	7	11	1	2	1	1	14	0	0	11	0
APR	60	42	51	88	23	2.0	3.7	.8	1.7	*	4	4	83	58	.26	41	1030	35	5	39	7	13	1	*	*	2	13	0	1	2	0
MAY	67	49	58	91	30	2.6	4.4	.9	1.4	#	*	*	85	55	.32	47	850	35	5	44	7	14	1	0	0	5	13	*	3	*	0
JUN	73	55	64	93	37	3.2	6.2	.9	1.8	0	0	0	87	57	.42	54	800	35	4	38	7	13	2	0	0	6	12	*	8	0	0
JUL	77	57	67	100	40	2.7	5.7	.3	2.0	0	0	0	87	55	.43	56	700	35	4	32	6	12	1	0	0	6	12	3	11	0	0
AUG	75	57	66	97	43	3.2	7.1	1.3	2.7	0	0	0	89	58	.45	56	750	35	4	50	7	14	1	0	0	5	14	2	9	0	0
SEP	70	52	61	90	32	2.1	5.2	.1	1.6	0	0	0	90	62	.39	52	800	35	4	37	6	11	1	0	0	2	19	*	3	*	0
OCT	59	44	52	82	26	1.9	3.9	*	1.3	#	#	*	91	69	.31	46	950	35	4	37	7	11	1	0	0	*	22	0	*	2	0
NOV	47	37	42	72	19	1.9	4.5	.2	1.1	1	6	3	88	78	.23	33	1250	35	5	44	8	14	#	1	*	*	20	0	0	7	0
DEC	40	32	36	63	7	2.0	4.4	.1	1.4	3	14	4	88	82	.16	32	1400	35	5	44	8	14	1	3	1	0	21	0	0	16	0
ANN	58	43	51	100	-6	26.8	7.1	*	2.7	16	15	8	87	66	.26	43	1050	35	5	52	7	153	12	16	4	27	197	5	35	73	*
EYR	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	19	21	21	8	20	21	21	21	21	21	21	21	21	21	21

REMARKS: RUSSWO FOR:
HRLY OBS: APR 51-JUL 72
AND
DAILY OBS:

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT AS APPLICABLE. ** INSTANTANEOUS PEAK WINDS $= % CALM GRTR ≥ PVLG DRCTN

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	49	46	20	16	11	10	11	12	17	36	43	38	26	
	03-05	51	47	27	23	18	22	19	21	30	43	52	58	34	
	06-08	56	35	43	33	25	20	23	28	42	58	60	63	43	
	09-11	60	37	44	33	20	23	17	22	32	51	50	64	40	
	12-14	56	52	32	24	14	16	12	13	17	33	52	61	32	
	15-17	53	47	22	14	10	11	7	8	11	23	48	58	26	
	18-20	51	44	19	11	8	9	7	6	10	28	46	55	25	
	21-23	49	44	18	11	8	9	9	8	11	28	47	55	25	
	ALL HRS	53	49	28	21	14	16	13	15	21	39	51	59	32	21
CEILING LESS THAN 1500 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	35	36	13	9	5	7	6	8	12	27	34	39	19	
	03-05	36	37	16	15	12	17	14	15	24	37	36	41	25	
	06-08	41	43	34	24	18	21	16	22	37	30	43	46	33	
	09-11	46	45	33	18	10	11	8	11	22	41	44	47	28	
	12-14	40	38	20	8	4	5	3	5	9	25	36	41	20	
	15-17	39	34	13	4	3	4	2	3	6	20	33	40	17	
	18-20	36	34	12	4	3	3	3	3	6	21	31	38	16	
	21-23	36	33	10	6	4	5	5	4	8	21	32	38	17	
	ALL HRS	39	38	19	11	7	9	7	9	16	30	36	41	22	21
CEILING LESS THAN [illegible] FT AND/OR VISIBILITY LESS THAN 2 MI	00-02	22	23	6	4	3	3	3	4	7	19	23	24	12	
	03-05	24	24	8	8	6	9	7	7	16	26	24	25	15	
	06-08	29	33	21	13	6	10	8	12	24	38	32	30	22	
	09-11	33	34	18	8	3	4	3	5	12	28	29	33	18	
	12-14	27	25	10	3	1	2	1	2	4	13	23	27	12	
	15-17	25	22	6	2	1	2	1	1	3	12	21	27	10	
	18-20	23	23	5	2	1	2	1	1	3	14	20	25	10	
	21-23	23	21	5	3	1	2	2	2	3	15	21	24	10	
	ALL HRS	26	26	10	5	3	4	3	4	9	21	24	27	14	21
[illegible]	00-02	7	8	1	1	*	*	*	*	1	10	5	8	4	
	03-05	6	8	2	1	1	1	2	1	6	13	9	8	5	
	06-08	7	11	4	2	*	1	1	1	8	16	11	8	6	
	09-11	8	9	2	*	0	*	0	0	1	8	7	9	4	
	12-14	6	4	1	#	0	0	0	*	*	1	4	6	2	
	15-17	6	4	*	*	0	*	0	0	*	2	5	6	2	
	18-20	5	4	*	0	0	#	0	0	0	4	6	6	2	
	21-23	7	5	1	#	0	0	*	*	*	6	7	7	3	
	ALL HRS	7	7	1	1	*	*	*	*	2	8	7	7	3	21

AD-A043 840 ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KANS F/G 15/5
AERIAL RESUPPLY OF ENCIRCLED ARMY UNITS DURING A MID-INTENSITY --ETC(U)
JUN 77 G A SCHNELZER

UNCLASSIFIED NL

2 OF 2
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A043840

END
DATE
FILMED
9-77
DDC

PREPARED BY: USAFETAC JUNE 1974 | STATION NAME: KITZINGEN AAF GERMANY | LOCATION: N49 45 E010 12 | PERIOD: FEB 46-JUL 72 S | ELEV: 689 | STATION: 34491 WBAN NO / 10659 WMO NO

AWS CLIMATIC BRIEF

MONTH	TEMP MEAN DAILY MAX (°F)	TEMP MEAN DAILY MIN	TEMP MEAN MONTHLY	TEMP EXTREME MAX	TEMP EXTREME MIN	PRECIP MONTHLY MEAN (IN)	PRECIP MONTHLY MAX	PRECIP MONTHLY MIN	PRECIP MAX 24 HRS	SNOWFALL MONTHLY MEAN (IN)	SNOWFALL MONTHLY MAX	SNOWFALL MAX 24 HRS	MEAN REL. HUMIDITY (%) LST 04	MEAN REL. HUMIDITY (%) LST 13	MEAN VAPOR PRESSURE (IN HG)	MEAN DEW PT (°F)	PRESSURE ALTITUDE FT 99.95%	PVLG DRCTN 16 PT	SPEED MEAN (KT)	SPEED MAX (KT) **	MEAN SKY COVER (tenths)	PRECIP ≥ 0.01	PRECIP ≥ 0.5	SNOWFALL ≥ 0.1	SNOWFALL ≥ 1.5	THUNDERSTORMS	FOG VSBY < 1/2 MI	TEMP MAX ≥ 90	TEMP MAX ≥ 80	TEMP MIN ≤ 32	TEMP MIN ≤ 0
JAN	33	26	31	56	-3	1.3	2.9	.5	.6	7	*	6	85	61	.14	26	1450	SW	5	40	8	14	#	5	1	0	23	0	0	25	1
FEB	42	30	36	60	1	1.6	3.7	.1	.7	6	13	4	86	75	.16	29	1630	SW	5	41	8	14	1	6	1	#	19	0	0	15	0
MAR	48	33	41	77	10	1.6	3.6	.3	1.1	2	5	3	84	66	.19	33	1550	SW	6	49	7	12	#	3	1	#	17	0	0	14	0
APR	58	40	49	86	24	2.1	3.3	1.4	1.0	#	2	2	83	57	.24	39	1400	SW	6	36	7	13	1	1	#	1	15	0	1	3	0
MAY	67	48	57	86	31	2.4	5.6	.6	1.7	#	#	#	85	56	.31	46	1150	SW	5	37	7	11	1	0	0	4	13	0	3	#	0
JUN	72	53	63	91	39	2.4	4.7	.0	1.8	0	0	0	87	55	.39	52	1050	SW	4	40	7	12	1	0	0	5	14	1	7	0	0
JUL	75	55	56	97	40	2.1	4.1	.3	1.5	0	0	0	87	54	.42	54	1030	SW	4	40	6	9	1	0	0	5	16	3	10	0	0
AUG	74	55	65	95	42	3.1	5.1	1.4	1.2	0	0	0	88	58	.42	54	1050	SW	4	39	7	14	2	0	0	3	18	2	8	0	0
SEP	63	49	59	87	31	1.7	3.6	.6	.8	0	0	0	91	61	.36	50	1100	SW	4	35	6	11	1	0	0	2	22	0	2	#	0
OCT	59	42	51	76	26	1.1	1.9	.1	.8	#	#	#	91	68	.29	44	1250	SW	4	42	7	8	#	0	0	#	24	0	#	5	0
NOV	46	36	41	67	18	1.3	1.8	.7	.9	2	5	4	88	75	.21	35	1600	SW	6	40	8	13	#	2	#	#	22	0	0	11	0
DEC	37	28	33	56	-6	1.2	1.8	.7	.9	5	8	4	98	82	.15	29	1650	SW	5	36	8	11	#	5	1	0	24	0	0	21	#
ANN	57	41	49	97	-6	21.9	5.6	.0	1.8	22	.7	6	87	66	.26	41	1350	SW	5	59	7	142	8	2	4	22	229	6	31	92	1
EYR	9	9	9	9	9	9	9	9	9	10	10	10	13	14	14	14	13	14	14	5	13	9	9	10	10	9	9	9	9	9	9

REMARKS RUSSWO POR:
HRLY OBS: FEB, APR-JUN, AUG-SEP 46, DEC 46-JUL 47, (34163)
AND AUG 59-JUL 72 (34191) (12 OBS/DAY: FEB, APR 46,
DAILY OBS: 11-18 OBS/DAY: AUG 59-JUL 63, APR 72)

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT AS APPLICABLE. ** INSTANTANEOUS PEAK WINDS. ≠ = % CALM GRTR THAN PVLG DRCTN

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	57	42	24	15	9	10	5	8	12	39	46	58	27	10
	03-05	57	45	32	19	14	17	13	16	28	51	49	55	33	13
	06-08	59	51	44	26	21	22	18	26	40	53	53	59	40	14
	09-11	59	50	44	30	24	22	17	24	30	50	53	59	39	14
	12-14	55	47	39	27	20	20	13	17	16	31	46	53	32	14
	15-17	52	42	29	19	14	12	10	10	8	22	42	56	26	14
	18-20	53	39	26	13	9	9	6	6	6	22	47	58	25	13
	21-23	54	40	24	11	8	8	5	6	8	23	46	57	24	12
	ALL HRS	56	45	33	20	15	15	11	14	19	37	48	57	31	
CEILING LESS THAN 1500 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	43	32	13	7	4	5	3	4	8	30	32	43	19	10
	03-05	43	33	22	11	10	10	9	11	22	42	34	42	24	13
	06-08	43	36	31	18	14	13	13	19	36	49	38	42	30	14
	09-11	48	37	28	13	7	6	3	12	23	36	33	44	25	14
	12-14	40	27	17	6	4	4	3	3	7	16	31	37	16	14
	15-17	36	25	10	4	2	2	2	2	3	10	26	36	13	14
	18-20	40	28	11	3	1	2	1	1	3	13	31	38	15	13
	21-23	41	29	13	4	2	2	2	2	5	18	31	40	16	12
	ALL HRS	42	31	18	8	6	6	5	7	13	27	33	40	20	
CEILING LESS THAN 1000 FT AND/OR VISIBILITY LESS THAN 2 MI	00-02	22	17	6	#	1	2	1	1	4	17	15	21	9	10
	03-05	24	19	10	3	4	5	4	5	15	29	19	22	13	13
	06-08	26	21	17	8	7	8	6	10	28	37	21	24	16	14
	09-11	29	23	14	4	3	3	2	4	12	26	23	23	14	14
	12-14	24	15	6	1	1	1	2	1	2	9	16	20	8	14
	15-17	21	12	3	1	4	1	1	1	1	3	14	19	7	14
	18-20	23	16	4	2	#	1	1	1	1	6	16	21	8	13
	21-23	22	16	4	1	1	1	#	1	1	9	17	21	8	12
	ALL HRS	24	17	8	3	2	3	2	3	8	17	18	22	11	
CEILING LESS THAN 200 FT AND/OR VISIBILITY LESS THAN 1/2 MI	00-02	3	4	1	0	0	#	0	0	2	7	4	3	2	10
	03-05	3	3	1	1	1	1	1	2	7	16	5	3	4	13
	06-08	3	4	4	2	2	1	1	4	15	22	7	4	6	14
	09-11	5	3	1	#	#	#	0	#	4	11	5	3	3	14
	12-14	2	1	#	#	0	0	0	0	#	1	1	3	1	14
	15-17	2	1	#	0	0	0	0	0	0	#	2	2	1	14
	18-20	2	1	#	#	0	0	0	0	0	1	1	2	1	13
	21-23	2	2	#	0	0	0	0	0	#	2	4	2	1	12
	ALL HRS	3	2	1	#	#	#	0	1	4	6	4	3	2	

AWS CLIMATIC BRIEF	FEUCHT AAF/NÜRNBERG, GERMANY	PERIOD 1968-70[1]	WBAN # 34190
Prepared by ETAC (APR 1972)	N 49 23 E 11 10	FIELD ELEVATION 1240 ft	WMO # STN LTRS EDIG

MONTH	TEMPERATURE (°F) Extreme maximum [2]	Mean daily maximum [3]	Mean daily minimum [3]	Extreme minimum [2]	PRECIPITATION (in) Mean total [3]	Maximum in 24 hours	Mean snowfall [2]	Max snowfall in 24 hours	WIND (KT) Prevailing direction	Mean speed	Extreme (peak) speed	MEAN Relative humidity (%) 0700	Relative humidity (%) 1300	Dew point (°F)	Vapor pressure (in Hg)	Pressure altitude 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01 in [3]	Precip ≥ 0.5 in [3]	Snowfall ≥ 0.1 in [3]	Snowfall ≥ 1.5 in [3]	Thunderstorms [2]	Fog	TEMPERATURE (°F) Maximum ≥ 86 [3]	Maximum ≥ 77 [3]	Minimum ≤ 32 [3]	Minimum ≤ 0	Mean clouds (tenths)
JAN	50	34	25	11	1.5	0.6	3	6	SE	5	29	91	85	28	.15	2150	16	#	9	1	#		0	0	23	0	9
FEB	50	38	26	5	1.2	0.6	4	3	SSE	6	41	90	82	28	.15	2050	14	#	7	1	0		0	0	19	0	9
MAR	74	46	31	9	1.3	0.6	3	4	W	7	36	86	69	31	.17	2000	14	1	6	1	#		0	0	15	0	8
APR	86	55	37	25	1.7	0.4	1	4	W	6	37	84	64	37	.22	1950	15	0	3	#	1		#	#	5	0	7
MAY	86	65	45	31	2.2	1.0	#	1	W	6	30	83	59	45	.30	1800	15	1	#	0	3		#	4	#	0	8
JUN	86	70	51	41	2.5	1.2	0	0	W	6	30	82	58	51	.38	1600	15	2	0	0	6		1	8	0	0	8
JUL	90	73	54	39	3.1	1.1	0	0	W	5	36	82	56	53	.40	1550	15	2	0	0	5		3	11	0	0	7
AUG	90	71	53	41	3.2	3.4	0	0	W	4	38	89	64	54	.42	1700	15	2	0	0	4		2	8	0	0	7
SEP	86	65	47	31	2.1	1.2	0	#	W	4	32	91	62	50	.36	1750	13	1	0	0	2		#	3	#	0	6
OCT	72	54	40	29	2.1	1.1	#	#	W	4	42	94	71	45	.30	1650	13	1	1	0	#		0	0	4	0	7
NOV	66	43	33	23	1.9	0.6	1	6	S	5	46	91	79	37	.22	2100	14	#	4	1	#		0	0	12	0	9
DEC	50	36	28	-3	1.7	0.3	3	3	SSE	4	43	91	85	25	.14	2150	17	0	8	1	0		0	0	19	#	8
ANN	90	54	39	-3	24.5	3.4	15	6	W	5	46	88	70	40	.25	1950	176	10	38	5	21		6	34	97	#	8
EYR	3	10	10	3	40	2	3	3	3	3	1	3	3	3	3	3	40	2	40	2	3		80	80	80	3	3

REMARKS

[1] LESS THAN FULL TIME OPERATION.
[2] EXTREMES OF 2°F CLASS INTERVALS.
[3] ESTIMATED FROM NEARBY STATION.

RUSSWO FOR: HRLY AND DAILY OBS: 6801-7012, LCTD APRX 8 NM SSE OF NÜRNBERG APRT.

NOTE; =DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
	00-02														
CIG	03-05														
less than	06-08	74	67	45	43	32	30	30	50	44	74	56	71	51	
3000 feet	09-11	65	69	44	43	26	26	18	38	23	52	54	68	44	
and/or	12-14	59	52	43	41	26	23	13	30	20	37	45	58	37	
VSBY	15-17	53	51	39	28	16	15	8	18	12	29	45	62	31	
less than	18-20	60	57	34	20	9	9	7	11	11	29	48	68	30	
3 miles	21-23														
MEAN OF LISTED HOURS		62	59	41	35	22	21	15	29	22	44	50	65	39	3
	00-02														
CIG	03-05														
less than	06-08	67	53	34	31	23	28	24	45	41	64	44	59	43	
1500 feet	09-11	64	57	31	19	12	12	8	27	16	44	43	60	33	
and/or	12-14	49	34	26	12	7	8	2	12	8	18	33	50	22	
VSBY	15-17	45	35	15	9	6	5	0	8	5	14	28	52	19	
less than	18-20	53	40	19	13	3	5	0	5	6	15	30	55	20	
3 miles	21-23														
MEAN OF LISTED HOURS		56	44	25	17	10	12	7	19	15	31	36	55	27	3
	00-02														
CIG	03-05														
less than	06-08	40	34	24	19	12	14	14	36	30	49	29	42	29	
1000 feet	09-11	38	32	21	10	4	6	3	20	11	30	30	43	21	
and/or	12-14	32	19	13	7	4	4	#	8	5	8	22	35	13	
VSBY	15-17	30	20	9	5	2	3	0	4	4	4	20	36	11	
less than	18-20	30	22	13	5	0	4	0	4	4	7	23	42	13	
2 miles	21-23														
MEAN OF LISTED HOURS		34	25	16	9	4	6	3	14	11	20	25	40	17	3
	00-02														
CIG	03-05														
less than	06-08	4	4	2	1	1	2	3	7	9	20	5	2	5	
200 feet	09-11	5	3	#	1	0	0	0	1	1	7	5	3	2	
and/or	12-14	4	1	0	0	0	0	0	0	0	#	2	2	1	
VSBY	15-17	5	0	0	0	0	0	0	0	0	#	1	3	1	
less than	18-20	5	0	0	0	0	0	0	0	0	2	4	3	1	
½ mile	21-23														
MEAN OF LISTED HOURS		5	2	#	#	#	#	1	2	2	5	3	3	2	3

AWS CLIMATIC BRIEF

Prepared by ETAC (AUG 1971)

WIESBADEN AB/ERBENHEIM, GERMANY — N 50 03 E 08 20

PERIOD 1946-65 — FIELD ELEVATION: 460 ft

WBAN # 35010, WMO # 10633, STN LTRS EDAW

MONTH	TEMPERATURE (°F) Extreme Maximum	Mean Daily Maximum	Mean Daily Minimum	Extreme Minimum	PRECIPITATION (in) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction [1]	Mean Speed	Extreme (Peak) (Gust) Speed	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01 in	Precip ≥ 0.5 in	Snowfall ≥ 0.1 in	Snowfall ≥ 1.5 in	Thunderstorms	Fog (< 7 miles)	Temperature (°F) Maximum ≥ 90	Maximum ≥ 80	Minimum ≤ 32	Minimum ≤ 0	Mean Clouds (Tenths)
JAN	57	37	29	3	1.5	1.3	4	4	WSW	6	50	85	79	28	.15	1400	13	#	5	1	#	19	0	0	20	0	8
FEB	63	40	29	-3	1.2	0.6	3	5	ENE	6	38	84	74	28	.15	1500	11	#	4	1	#	17	0	0	17	#	7
MAR	71	50	35	9	1.2	0.9	1	2	ENE	7	32	82	65	33	.19	1350	9	#	1	#	#	14	0	0	11	0	6
APR	86	60	42	28	1.0	0.7	#	1	NNE	7	38	79	56	39	.24	1150	11	#	#	0	1	8	0	#	2	0	6
MAY	89	67	49	33	1.6	0.9	#	#	NNE	6	23	80	54	45	.30	900	11	1	0	0	4	7	0	2	0	0	6
JUN	96	72	54	38	1.9	2.3	0	0	W	6	31	83	55	51	.38	900	11	1	0	0	5	10	1	6	0	0	6
JUL	99	76	57	41	2.0	1.4	0	0	W	5	34	84	56	54	.42	850	11	1	0	0	5	10	2	9	0	0	6
AUG	95	74	56	42	2.3	1.5	0	0	W	5	45	85	57	54	.42	900	12	1	0	0	4	13	1	7	0	0	6
SEP	93	69	52	35	1.6	1.1	0	0	WSW	5	35	86	63	51	.38	850	10	#	0	0	1	18	#	3	0	0	6
OCT	79	57	43	24	1.4	1.6	#	#	ENE	5	39	88	70	43	.28	1050	10	#	#	0	#	21	0	0	2	0	6
NOV	62	46	37	15	1.8	1.3	1	4	ENE	5	29	83	80	37	.22	1350	13	1	1	#	#	21	0	0	7	0	8
DEC	60	39	31	7	1.8	1.4	3	5	ENE	5	39	87	83	31	.17	1500	13	1	3	1	#	22	0	0	16	0	8
ANN	99	57	43	-3	19.3	2.3	12	5	ENE	6	50	84	66	42	.27	1200	135	6	14	3	20	180	4	27	75	#	7
EYR	19	19	19	19	19	18	19	19	20	20	3	20	20	20	20	18	19	19	19	19	19	19	19	19	19	19	20

REMARKS

[1] SIGNIFICANT AS SECONDARY PREVAILING DIRECTION:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ENE	WSW	WSW	WSW	W	NNE	-	-	ENE	WSW	WSW	WSW	WSW

RUSSWO POR: HRLY OBS: 4603-6510. DAILY OBS: 4603-6410.

NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02	54	51	27	13	7	9	8	9	16	34	55	65	29	
	03-05	57	55	35	19	12	15	14	16	24	45	58	65	35	
	06-08	61	57	46	31	20	24	23	28	41	55	64	68	43	
	09-11	67	63	51	30	20	21	22	25	42	57	68	71	45	
	12-14	65	51	40	19	13	12	11	13	25	47	63	70	36	
	15-17	60	50	28	12	9	9	7	6	14	34	58	67	30	
	18-20	56	49	25	11	5	7	6	5	12	31	51	62	27	
	21-23	53	45	22	9	5	7	7	6	12	29	51	64	26	
	ALL HOURS	59	53	34	18	11	13	12	13	23	42	59	67	34	20
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	36	35	17	6	3	5	3	5	11	27	37	45	19	
	03-05	38	39	22	9	7	9	8	11	18	35	40	46	24	
	06-08	41	43	33	19	14	16	17	21	35	46	47	49	32	
	09-11	50	49	37	17	9	10	9	15	32	47	53	55	32	
	12-14	45	41	24	7	3	2	3	5	16	34	43	51	23	
	15-17	41	34	16	3	2	2	2	2	8	26	39	49	19	
	18-20	39	35	16	4	2	2	2	2	9	25	34	44	18	
	21-23	36	32	14	4	2	4	2	3	8	23	34	44	17	
	ALL HOURS	41	39	22	9	5	6	6	8	17	33	41	48	23	20
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02	24	21	8	2	1	3	1	3	5	17	23	30	12	
	03-05	26	24	11	4	3	5	3	6	10	25	27	32	15	
	06-08	27	28	20	9	6	7	7	11	23	36	32	35	20	
	09-11	36	34	22	8	3	3	3	6	18	36	38	41	21	
	12-14	30	26	14	2	1	1	1	1	6	23	30	37	14	
	15-17	28	23	8	1	1	1	#	1	3	16	26	36	12	
	18-20	25	22	7	1	#	1	1	1	4	14	22	30	11	
	21-23	24	19	6	2	1	1	1	1	3	14	21	28	10	
	ALL HOURS	28	25	12	3	2	3	2	4	9	22	27	34	14	20
CIG less than 200 feet and/or VSBY less than ½ mile	00-02	7	5	1	0	0	#	0	#	1	7	5	10	3	
	03-05	8	7	2	#	#	1	#	1	2	12	9	11	4	
	06-08	9	9	4	1	1	1	1	2	7	19	11	12	6	
	09-11	10	9	4	1	#	#	0	#	3	13	10	12	5	
	12-14	7	5	1	#	#	#	0	0	1	4	4	10	3	
	15-17	6	5	#	0	#	#	0	#	2	5	9	2		
	18-20	4	4	#	#	0	0	0	0	0	3	4	8	2	
	12-23	5	4	1	0	0	0	#	0	0	4	6	8	2	
	ALL HOURS	7	6	2	#	#	#	#	#	2	8	7	10	4	20

CB DATED JAN 71 OBSOLETE

PREPARED BY: USAFETAC JUNE 1974 | STATION NAME: BENTWATERS RAF STN ENGLAND | LOCATION: N52 05 E001 26 | PERIOD: JUN 51-JUL 72 B | ELEV: 85 | STN LTRS: EGVJ | WBAN NO: 35048 | WMO NO: 03596

AWS CLIMATIC BRIEF

MONTH	TEMPERATURE (°F) MEAN DAILY MAX	MEAN DAILY MIN	MEAN MONTHLY	EXTREME MAX	EXTREME MIN	PRECIPITATION (IN) MONTHLY MEAN	MONTHLY MAX	MONTHLY MIN	MAX 24 HRS	SNOWFALL (IN) MONTHLY MEAN	MONTHLY MAX	MAX 24 HRS	MEAN RELATIVE HUMIDITY (%) LST 03	LST 12	MEAN VAPOR PRESSURE (IN Hg)	MEAN DEW PT (°F)	PRESSURE ALTITUDE (FT) 99.95%	SURFACE WINDS PVLG DRCTN (16 PT)	SPEED MEAN (KT)	SPEED MAX (KT) **	MEAN CLOUD COVER (tenths)	MEAN NO. OF DAYS: PRECIP (IN) ≥ 0.01	PRECIP ≥ 0.5	SNOWFALL (IN) ≥ 0.1	SNOWFALL ≥ 1.5	THUNDERSTORMS	FOG VSBY < 7 MI	TEMPERATURE (°F) MAX ≥ 90	MAX ≥ 80	MIN ≤ 32	MIN ≤ 00
JAN	42	34	38	58	9	2.1	4.0	.4	.8	3	11	6	86	80	.20	34	1300	W	9	49	8	16	1	3	1	#	18	0	0	13	0
FEB	43	34	39	60	15	1.5	2.4	.2	.6	4	21	5	85	77	.19	33	1350	W	8	69	8	13	#	3	1	#	15	0	0	11	0
MAR	48	36	42	71	19	1.6	3.7	.3	1.1	2	6	4	85	70	.20	35	1150	W	8	54	7	12	#	2	#	1	16	0	0	8	0
APR	53	40	46	73	26	1.3	3.2	.2	.8	#	1	1	86	66	.24	39	1000	W	8	43	7	12	#	#	0	1	13	0	0	3	0
MAY	60	45	53	76	29	1.5	4.0	.3	1.5	#	#	#	86	64	.30	45	750	$ W	7	41	7	11	#	0	0	2	12	0	0	#	0
JUN	65	50	58	86	35	1.8	3.8	.1	1.2	0	0	0	85	63	.35	49	650	W	7	37	7	10	1	0	0	2	12	0	#	0	0
JUL	68	54	61	86	40	2.1	4.5	.2	2.0	0	0	0	88	56	.40	53	650	W	7	45	7	10	1	0	0	2	11	0	1	0	0
AUG	68	54	61	83	39	2.4	4.9	.8	1.2	0	0	0	89	65	.42	54	750	SW	7	40	7	12	1	0	0	3	14	0	#	0	0
SEP	65	50	58	80	34	1.9	5.2	.1	2.2	#	#	#	88	66	.38	51	800	$ W	7	44	6	11	1	0	0	2	16	0	#	0	0
OCT	58	46	53	76	30	2.1	6.4	.2	2.2	0	0	0	88	72	.32	47	950	$ SW	7	48	7	12	1	0	0	#	19	0	0	#	0
NOV	50	40	45	65	20	2.8	5.8	.4	1.5	1	8	4	86	78	.25	40	1300	$ W	8	51	7	16	1	#	#	#	17	0	0	4	0
DEC	45	36	41	61	16	2.3	4.1	.9	1.2	1	6	4	86	81	.21	36	1400	W	8	55	7	15	1	1	#	#	20	0	0	9	0
ANN	55	43	50	86	9	23.4	6.4	.1	2.2	11	21	6	87	71	.28	43	1050	W	8	55	7	150	8	9	2	13	183	0	1	48	0
EYR	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	20	20	14	19	20	20	20	20	20	20	20	20	20	20

REMARKS: RUSSWO POR:
HRLY OBS: JUN 51-JAN 57, JAN-AUG 58,
AND OCT 58-JUN 66, AUG 66-JUL 72
DAILY OBS:

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT AS APPLICABLE. ** INSTANTANEOUS PEAK WINDS $= % CALM GRTR % PVLG DRCTN

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	57	53	42	33	22	27	20	26	32	42	48	57	38	
	03-05	57	56	47	42	32	35	30	34	38	46	49	58	44	
	06-08	61	59	54	44	33	36	31	36	43	53	53	57	47	
	09-11	60	57	50	42	33	33	36	35	34	42	47	57	44	
	12-14	57	54	45	34	24	27	26	26	25	34	44	51	37	
	15-17	57	48	41	25	17	19	17	18	17	30	43	56	32	
	18-20	61	51	40	25	17	17	14	17	20	35	46	57	33	
	21-23	59	50	40	29	21	22	16	22	26	37	45	56	35	
	ALL HRS	59	54	45	34	23	27	24	27	29	40	47	56	39	20
CEILING LESS THAN 1500 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	47	41	35	25	18	21	16	22	26	36	37	48	31	
	03-05	46	43	40	32	26	29	25	29	32	39	39	48	36	
	06-08	49	47	45	34	24	27	23	30	35	45	41	47	37	
	09-11	48	45	38	23	16	16	16	17	18	32	37	46	29	
	12-14	44	38	26	15	9	12	9	11	10	20	30	40	22	
	15-17	46	36	24	12	7	9	8	10	9	20	32	45	22	
	18-20	49	39	29	17	11	11	8	11	15	27	36	47	25	
	21-23	48	39	31	21	16	17	12	18	20	31	36	46	28	
	ALL HRS	47	41	34	22	16	18	13	19	21	31	36	46	29	20
CEILING LESS THAN 1000 FT AND/OR VISIBILITY LESS THAN 2 MI	00-02	32	26	23	15	11	14	9	14	15	24	22	31	20	
	03-05	32	28	27	20	17	21	14	19	22	26	23	33	24	
	06-08	34	31	31	19	14	17	14	19	23	29	27	32	24	
	09-11	32	30	22	12	9	8	7	8	9	18	26	30	17	
	12-14	27	22	14	8	4	6	3	5	4	8	17	24	12	
	15-17	30	21	13	6	3	5	3	5	4	8	17	27	12	
	18-20	32	24	17	9	5	5	4	6	7	15	20	30	15	
	21-23	32	24	19	12	9	10	6	9	10	18	21	32	17	
	ALL HRS	31	26	21	13	9	11	8	11	12	18	21	30	18	20
CEILING LESS THAN 200 FT AND/OR VISIBILITY LESS THAN 1/2 MI	00-02	9	5	5	3	3	2	1	3	4	6	6	6	4	
	03-05	9	5	6	5	3	4	3	4	6	8	6	7	6	
	06-08	9	8	8	4	1	1	1	3	6	8	7	7	5	
	09-11	8	6	3	1	#	0	0	#	1	2	3	6	3	
	12-14	5	3	1	#	0	0	0	0	#	#	1	4	1	
	15-17	6	3	1	#	#	#	#	#	#	1	1	5	1	
	18-20	7	4	2	1	1	1	#	#	1	2	2	6	2	
	21-23	8	4	4	2	1	1	#	1	2	4	4	7	3	
	ALL HRS	8	5	4	2	1	1	1	1	3	4	4	6	3	20

CB DATED SEP 70 OBS__TE

PREPARED BY: USAFETAC NOVEMBER 1974	STATION NAME: MILDENHALL RAF STN ENGLAND LOCATION: N52 22 E000 29	PERIOD: JUL 50-DEC 72 & ELEV: 33	STN LTRS: EGUN WBAN NO.: 35046 WMO NO.:

AWS CLIMATIC BRIEF

MONTH	Temp (°F) Mean Daily Max	Temp Mean Daily Min	Temp Mean Monthly	Temp Extreme Max	Temp Extreme Min	Precip (IN) Monthly Mean	Precip Monthly Max	Precip Monthly Min	Precip Max 24 Hrs	Snowfall (IN) Monthly Mean	Snowfall Monthly Max	Snowfall Max 24 Hrs	Mean Rel. Humidity (%) LST 03	Mean Rel. Humidity (%) LST 12	Mean Vapor Pressure (IN Hg)	Mean Dew Pt (°F)	Pressure Altitude (FT) 99.95%	Surface Winds PVLG DRCTN (16 PTS)	Speed Mean (KT)	Speed Max (KT) **	Mean Cloud Cover (tenths)	Precip ≥ 0.01	Precip ≥ 0.5	Snowfall ≥ 0.1	Snowfall ≥ 1.5	Thunderstorms	Fog Vsby < 7 MI	Temp Max ≥ 90	Temp Max ≥ 80	Temp Min ≤ 32	Temp Min ≤ 00
JAN	43	34	38	58	5	1.6	3.7	.7	1.4	2	6	5	86	80	.20	34	1300	SW	8	32	8	15	#	2	#	#	17	0	0	13	0
FEB	45	34	39	62	11	1.4	3.5	.1	1.3	3	14	7	84	74	.20	34	1350	SW	8	56	7	12	#	2	#	#	15	0	0	11	0
MAR	50	36	43	77	17	1.4	3.5	.3	.8	1	6	5	84	66	.20	35	1150	$ W	8	54	7	13	#	1	#	#	14	0	0	9	0
APR	55	39	47	79	24	1.5	3.4	.1	1.1	#	#	#	84	61	.24	39	950	SW	8	44	7	13	#	0	0	1	11	0	0	3	0
MAY	62	45	54	83	30	1.7	4.5	.1	2.3	#	#	#	85	59	.29	44	700	SW	8	41	7	12	1	0	0	3	11	0	#	#	0
JUN	67	50	59	90	31	1.9	4.0	#	1.6	0	0	0	87	59	.35	49	600	$ SW	7	38	7	11	1	0	0	3	10	#	2	#	0
JUL	70	53	62	91	40	2.2	3.7	.5	2.2	0	0	0∂	89	62	.40	53	600	W	7	45	7	13	1	0	0	3	12	#	2	0	0
AUG	69	53	61	91	41	2.1	3.6	.8	1.3	0	0	0	89	62	.40	53	700	SW	7	42	7	14	1	0	0	3	13	#	1	0	0
SEP	65	49	58	83	28	1.9	5.0	#	1.5	0	0	0	88	63	.36	50	800	$ SW	7	40	7	12	1	0	0	1	16	0	#	#	0
OCT	59	45	52	78	26	1.7	4.0	.1	1.5	0	0	0	88	71	.31	46	900	$ SW	7	49	7	11	1	0	0	#	20	0	0	1	0
NOV	49	39	44	67	19	2.1	5.2	.6	1.4	1	7	7	87	79	.25	40	1250	SW	8	55	7	16	1	#	#	#	18	0	0	6	0
DEC	44	35	40	59	9	1.8	3.2	.5	.9	1	7	5	86	82	.20	35	1300	SW	8	56	7	15	#	2	#	0	18	0	0	11	0
ANN	56	43	50	91	5	21.3	5.2	#	2.3	8	14	7	86	68	.28	43	1000	SW	8	56	7	157	7	7	#	14	177	#	5	54	0
EYR	20	20	20	20	20	20	20	20	20	19	19	19	19	21	21	21	21	21	21	13	19	20	20	19	19	19	19	20	20	20	20

REMARKS: RUSSWO POR:
HRLY OBS: JUL 50-SEP 54, APR 56-DEC 72
DAILY OBS: JUL 50-SEP 54, AUG 56-APR 65, JUN 65-DEC 72

NOTE: * DATA NOT AVAILABLE # AMTS < UNITS SHOWN IN HEADING ** INSTANTANEOUS PEAK WINDS $ % CALM GRTR % PLVG DRCTN ∂ BASED ON < FULL MONTHS

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	54	47	40	31	20	22	18	24	32	43	47	55	36	20
	03-05	55	51	46	40	34	34	30	36	41	48	47	53	43	19
	06-08	56	55	55	45	33	32	31	37	44	52	50	56	46	21
	09-11	56	54	52	44	34	35	38	36	35	45	47	57	44	21
	12-14	53	51	45	35	26	25	25	27	27	33	42	52	37	21
	15-17	57	42	32	24	18	17	15	17	16	25	43	59	30	21
	18-20	54	43	33	22	14	12	11	14	19	33	42	54	29	20
	21-23	53	43	34	24	17	18	14	18	22	36	43	54	31	20
	ALL HRS	55	48	42	33	25	24	23	26	30	40	45	55	37	
CEILING LESS THAN 1500 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	45	37	30	20	15	15	13	18	25	37	39	44	28	20
	03-05	45	41	36	29	26	26	24	30	35	41	38	42	34	19
	06-08	44	45	45	36	24	24	23	30	38	47	40	45	37	21
	09-11	46	46	36	20	13	15	14	15	21	35	39	47	29	21
	12-14	42	35	22	10	6	8	6	6	8	18	31	43	20	21
	15-17	44	29	16	9	5	6	5	6	6	17	32	50	19	21
	18-20	44	33	21	12	7	6	5	7	12	26	34	45	21	20
	21-23	42	34	23	13	11	12	9	11	16	30	36	45	24	20
	ALL HRS	44	38	29	19	13	14	12	15	20	31	36	45	26	
CEILING LESS THAN 1000 FT AND/OR VISIBILITY LESS THAN 2 MI	00-02	32	26	19	11	9	11	7	11	15	24	26	32	19	20
	03-05	31	28	25	18	17	18	14	22	24	27	27	30	23	19
	06-08	31	33	31	21	14	14	13	19	27	35	28	31	25	21
	09-11	32	32	21	9	6	8	5	6	12	22	26	31	18	21
	12-14	26	19	12	4	2	4	3	3	4	8	16	28	11	21
	15-17	28	16	8	3	2	3	2	3	3	8	19	32	11	21
	18-20	30	19	10	5	3	3	2	4	5	12	21	31	12	20
	21-23	31	22	14	8	6	6	4	6	7	18	22	31	15	20
	ALL HRS	30	24	18	10	7	8	6	9	12	19	23	31	16	
CEILING LESS THAN 200 FT AND/OR VISIBILITY LESS THAN 1/2 MI	00-02	8	6	4	2	2	2	1	3	5	7	7	9	5	20
	03-05	9	7	5	4	4	4	3	6	9	10	7	8	6	19
	06-08	10	7	5	4	2	1	1	4	10	11	8	9	6	21
	09-11	8	5	2	1	0	#	#	#	2	5	6	7	3	21
	12-14	5	1	1	#	0	0	#	#	#	1	3	5	1	21
	15-17	6	1	#	#	0	0	0	#	#	1	3	7	2	21
	18-20	7	2	#	#	0	0	#	0	#	2	5	7	2	20
	21-23	7	4	1	#	1	#	0	#	1	5	6	8	3	20
	ALL HRS	8	4	2	1	1	1	1	2	3	5	6	8	4	

AWS FORM APR 74 62
PREVIOUS EDITION IS OBSOLETE

AWS CLIMATIC BRIEF UPPER HEYFORD RAF STN/OXFORD, ENGLAND PERIOD 1951-67 WBAN # 15037 WMO # 03655

Prepared by ETAC (SEP 1970) N 51 56 W 01 15 ELEVATION: 477 ft STN LTRS EGUA

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM	PRECIPITATION (in) MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION	MEAN SPEED	EXTREME SPEED (Peak Gust)	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE (Feet) 99.95%	MEAN NUMBER OF DAYS PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ 1.5 in	THUNDERSTORMS	FOG (<7 miles)	TEMPERATURE (°F) MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32	MINIMUM ≤ 0	MEAN CLDNS (Tenths)
JAN	56	41	32	7	2.1	1.1	3	4	SW	10	51	89	83	33	.19	1650	14	#	3	#	#	19	0	0	15	0	7
FEB	61	42	32	12	1.1	0.7	2	4	SW	9	52	88	78	33	.19	1750	10	#	3	1	#	17	0	0	14	0	8
MAR	69	49	36	16	1.8	1.0	1	5	E	9	42	87	69	36	.21	1550	12	1	1	#	#	19	0	0	9	0	7
APR	74	55	40	28	1.6	0.5	#	#	NE	9	59	87	66	40	.25	1350	13	#	0	0	1	14	0	0	4	0	7
MAY	85	61	45	32	1.9	2.1	#	2	SW	9	40	86	63	44	.29	1150	12	1	#	#	2	11	0	#	#	0	7
JUN	88	66	50	36	1.9	2.3	0	0	SW	8	35	87	62	49	.35	1050	11	1	0	0	2	12	0	1	0	0	7
JUL	88	69	53	42	1.6	1.1	0	0	SW	8	36	88	64	52	.39	1050	11	#	0	0	2	14	0	1	0	0	7
AUG	90	68	53	42	2.1	1.1	0	0	SW	8	41	90	66	52	.39	1100	14	1	0	0	2	14	#	2	0	0	7
SEP	82	64	49	36	1.7	1.2	0	0	SW	8	43	90	68	50	.36	1200	11	1	0	0	1	17	0	#	0	0	7
OCT	76	57	44	27	2.4	1.0	#	#	SW	8	42	91	76	46	.31	1450	15	1	0	0	#	21	0	0	1	0	7
NOV	61	49	39	22	2.4	1.4	1	5	SW	8	51	90	82	40	.25	1750	15	1	1	#	#	21	0	0	6	0	8
DEC	58	45	35	15	2.3	1.1	2	6	SW	9	54	89	84	36	.21	1800	16	1	1	1	#	21	0	0	10	0	7
ANN	90	55	42	7	22.9	2.3	9	6	SW	9	59	89	72	42	.27	1450	154	8	9	2	10	200	#	4	59	0	7
EYR	15	15	15	15	15	15	15	15	16	16	15	16	16	16	16	16	15	15	15	15	15	15	15	15	15	15	16

REMARKS

RUSSWO POR: Hourly Obs: Nov 51 - Dec 67
Daily Obs: Nov 51 - Dec 66

NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00 - 02	64	62	52	35	27	28	23	23	34	50	60	62	43	
	03 - 05	63	64	58	46	40	43	38	38	44	56	60	61	51	
	06 - 08	62	65	66	58	44	47	41	44	52	59	62	61	55	
	09 - 11	60	65	60	55	47	48	46	50	48	56	60	62	55	
	12 - 14	63	61	55	46	38	38	36	36	38	49	56	60	48	
	15 - 17	61	53	39	33	28	27	24	22	24	34	52	61	38	
	18 - 20	58	52	40	27	20	20	13	15	22	35	49	57	34	
	21 - 23	61	53	41	29	22	24	16	18	24	41	55	59	37	
	ALL HOURS	62	59	51	42	34	35	30	31	36	48	57	60	46	16
CIG less than 1500 feet and/or VSBY less than 3 miles	00 - 02	51	47	42	26	19	22	17	16	25	41	51	50	34	
	03 - 05	49	50	46	35	31	37	20	32	36	46	50	50	41	
	06 - 08	48	51	54	45	37	37	32	38	44	51	51	50	45	
	09 - 11	48	51	47	29	18	20	19	24	28	44	49	52	36	
	12 - 14	48	39	27	16	10	12	8	10	14	27	39	47	25	
	15 - 17	46	35	21	12	9	8	5	8	11	20	38	47	22	
	18 - 20	46	38	27	13	9	9	6	8	13	26	38	43	23	
	21 - 23	49	41	32	17	12	15	10	12	17	33	45	41	27	
	ALL HOURS	48	44	37	24	17	20	16	18	24	36	45	49	32	16
CIG less than 1000 feet and/or VSBY less than 2 miles	00 - 02	37	32	28	15	11	15	11	10	18	30	38	38	24	
	03 --05	36	35	33	23	22	25	20	21	28	37	40	40	30	
	06 - 08	37	38	40	28	19	23	20	26	33	41	39	39	32	
	09 - 11	37	37	28	14	9	10	8	13	16	30	36	40	23	
	12 - 14	33	23	14	7	5	4	3	5	7	15	26	35	15	
	15 - 17	32	21	11	6	4	4	2	4	6	12	25	35	14	
	18 - 20	32	23	14	7	5	5	3	3	7	15	27	35	15	
	21 - 23	35	24	19	9	6	10	6	6	10	20	31	38	18	
	ALL HOURS	35	29	23	14	10	12	9	11	16	25	33	38	22	16
CIG less than 200 feet and/or VSBY less than 1/2 mile	00 - 02	11	7	5	1	2	1	#	#	3	8	11	14	5	
	03 - 05	11	10	8	4	4	3	3	5	7	13	14	15	8	
	06 - 08	11	13	11	5	2	2	2	4	11	17	16	14	9	
	09 - 11	12	10	4	1	#	#	#	#	3	8	10	15	5	
	12 - 14	8	4	1	#	#	#	0	#	#	2	3	10	2	
	15 - 17	8	3	1	#	#	0	#	0	#	1	3	9	2	
	18 - 20	8	4	2	#	#	#	0	#	#	1	5	9	2	
	21 - 23	10	5	2	1	#	#	0	#	#	3	7	12	3	
	ALL HOURS	10	7	4	2	1	1	1	1	3	7	9	12	5	16

GLOSSARY OF TERMS

AAA	Antiaircraft Artillery
ACL	Allowable Cabin Load
ALOC	Aerial Line of Communications
AMST	Advanced Medium STOL Transport
ARA	Airborne Radar Approach
AWACS	Airborne Warning and Control System
AWADS	Adverse Weather Aerial Delivery System
CARP	Computed Air Release Point
CEP	Circular Error Probable
CDS	Container Delivery System
ECM	Electronic Countermeasures
FEBA	Forward Edge of Battle Area
FPS	Feet Per Second
GCA	Ground Controlled Approach (Precision Radar)
GPS	Global Positioning System (Satellite Navigational System)
GRADS	Ground Radar Aerial Delivery System
ILS	Instrument Landing System
INS	Inertial Navigation System
IR	Infrared
IRCM	Infrared Countermeasures
KIAS	Indicated Airspeed
LAPES	Low Altitude Parachute Extraction System
LOC	Line of Communication
MAC	Military Airlift Command

NATO	North Atlantic Treaty Organization
NM	Nautical Mile
PELSS	Precision Emitter Locator and Strike System
POL	Petrolium, Oil, Lubricants
RPV	Remotely Piloted Vehicles
TAS	True Airspeed
SAM	Surface to Air Missile
SKE	Station Keeping Equipment
STOL	Short Takeoff and Landing
STONS	Short Tons (2,000 lbs)
VLF	Very Low Frequency

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